NATIONAL PETROLEUM NEWS

March 6, 1946

TECHNOLOGY DEPT.

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Aviation Petroleum Branch Solves AAF Avgas Problems

Keeping the largest air force in the world supplied with petroleum products was the job of the AAF's Aviation Petroleum Branch. The men of the branch estimated future requirements, helped the oil industry get its avgas refineries freed from governmental red tape, promoted research on new processes and helped solve shipping bottlenecks. For story on how the branch delivered the goods for the AAF, see p. 34.

Col. Harry W. Howze—wartime APB chief

Left, Maj. Francis J. O'Brien—assistant chief, and right, Lt. Col. Carl J. Gerken, chief, both of Allocation & Distribution Section

Left, Lt. Col. James A. Dawson, wartime chief, and right, Esmond A. VanName, civilian chief, both of Plans & Requirements Section

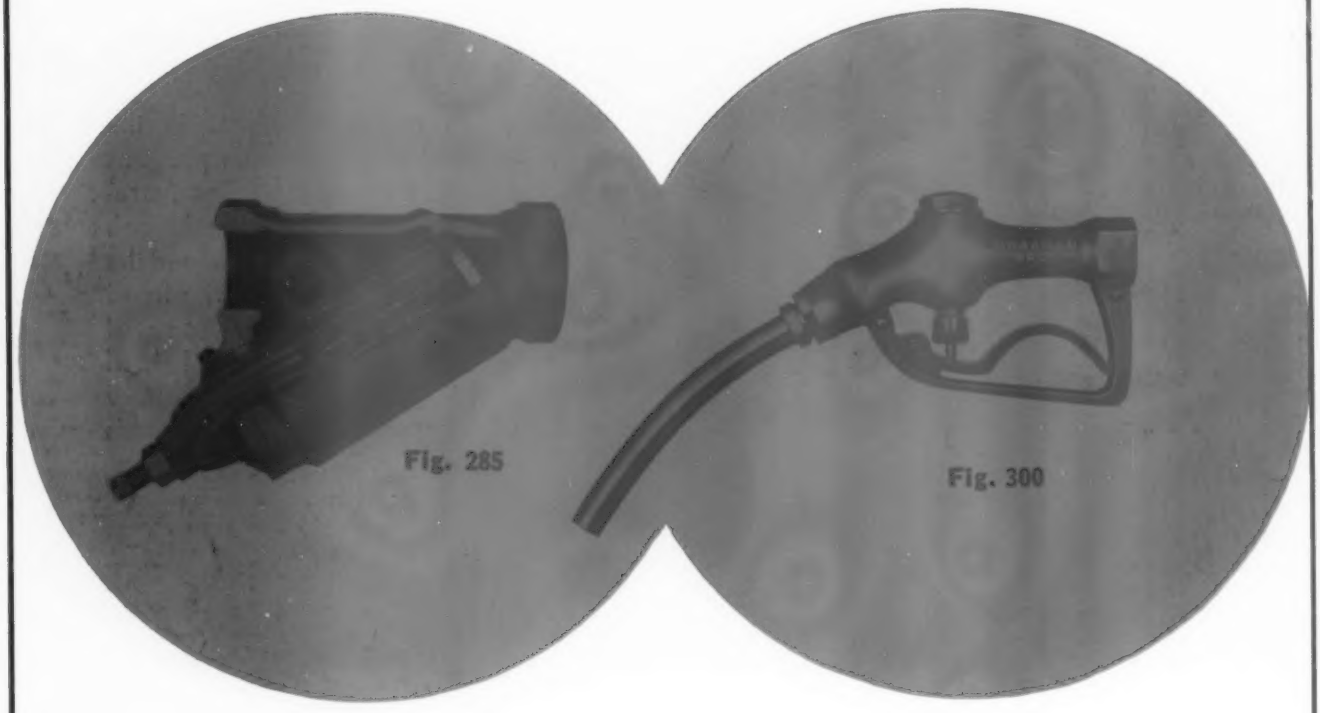
Lt. Col. Paul G. Benedum, chief, Production & Facilities Section

Lt. Col. H. Claire Dees, chief, Technical Progress & Liaison Section

Maj. Herbert Curling, APB executive officer

Maj. Robert W. Beers, new chief, Plans & Requirements Section (Captain in photo)

Production Is Underway!



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Oil's Aroma Stronger Than Ink Smell for Pennsy Crude Head

An oil executive who has lived in the atmosphere of the Pennsylvania Grade oil industry virtually from the cradle, and who found the oil field aroma stronger than the smell of printer's ink is W. Floyd Clinger of Warren, Pa., new president of the Pennsylvania Grade Crude Oil Assn.

Mr. Clinger, a former newspaper publisher, and a prominent member of Pennsylvania's educational system for 20 years, is no novice in occupying the president's chair, a position he filled capably from 1937 to 1940. He is now back in this post to complete the unexpired term of Don T. Andrus of Bradford, Pa., who resigned due to pressure of private business.

He was born at Fagundus, an early Pennsylvania oil town. His grandfather was Amos Clinger, one of the pioneers in the Pennsylvania oil development.

He attended public school in Tidioute, Pa., took a year out to sample the culture of Tulsa, Okla., High School, then returned to get his diploma from Tidioute High School in 1910. He continued his studies at the University of Pennsylvania in Philadelphia, and graduated from Wharton School in 1914.

Two years later he plunged into the newspaper business, buying the Warren Evening Mirror in Warren, Pa. He continued as editor and publisher of that popular and successful daily until 1921.

He then became associated with the Clinger Oil and Gas Co., a producing firm. He is now head of the Clinger Oil and Gas Co. He is also vice president and treasurer of Superior Oil Works, a jobbing concern with headquarters in Warren, dealing in products of Pennsylvania Grade crude.

This dual connection gives Mr. Clinger a familiarity with the problems of both the producing and refining divisions of the Pennsylvania Grade crude oil industry.

"It might be of interest to the readers of NPN to learn that an oil producer can be a part of an educational machine," Mr. Clinger commented. He recalled that he has served for 20 years on the Warren School Board, and is now a member of the Pennsylvania State Council of Education. He was president of the Warren School Board from 1937 to 1945.

Mr. Clinger has been a director of the Pennsylvania Grade Crude Oil Assn. since 1934. For some time he has been a member of the association's advertising committee. He also is a director of the API.

W. F. Clinger

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NPN
NATIONAL PETROLEUM NEWS
NEWSMAGAZINE FOR OIL MANAGEMENT MEN

OPA to Boost Crude Ceilings 10 Cents; New Prices Go into Effect This Month

Amount Is 25 Cents Less Than Urged by Advisory Group; Agency to Meet With Refiners to Discuss Absorption

NPN News Bureau

WASHINGTON—Ceiling prices for crude oil at producer level will be raised 10c per bbl. shortly, OPA announced March 5.

Official action granting the increase will become effective sometime during the last half of March.

Refiners, OPA said, will be required to absorb the increase and no price changes to public are contemplated at this time. However, such absorption and its effect on prices to public will be discussed in meetings between OPA and National Refiners Industry Advisory Committee, to begin at once.

OPA said increase would be authorized under the agency's earnings standard and as such was mandatory under the Price Control Act.

Data submitted by Crude Oil Advisory Committee, OPA said, show that higher costs of producers for wages, findings and developing crude oil, deeper drilling and production cutbacks have reduced their earnings to the extent that a large segement of the industry will not be able to maintain 1936-39 base earnings without a price increase. (See NPN Feb. 20, p. 46)

Price agency added that information available at this date "justifies" an immediate increase of at least 10c per bbl. to keep industry earnings generally from falling below the 1936-39 level.

However, a further cost study will be made at once, OPA said, and if this study shows the 10c increase is inadequate to maintain the industry's 1936-39 earnings a further increase "will have to be made."

Commenting upon crude oil committee's recommendation for industry-wide increase of 35c per bbl., OPA said this recommendation was based on so-called replacement costs, and that it was contrary to the agency's policy to base price increases on such replacement values. The 10c increase, however, is in line with results shown by the industry's own accounting practice, which relates current operating costs to current production, OPA said.

OPA continued that small high cost refiners who experience operating losses because of the full absorption requirement may be able to benefit from individual adjustments of their ceiling prices for products sold either directly to industrial users or for export, and which do not enter the general competitive field where an individual raising of prices is not practicable.

Considering Kerosine Price

NPN News Bureau

WASHINGTON — OPA said this week it is considering whether to continue in effect recent temporary price ceiling increases allowed in most parts of country on kerosine and heating oils, which are scheduled to expire either on April 30 or June 30.

Agency said these increases have particularly helped the small high cost refiners who in certain instances might find it difficult to absorb the contemplated 10c per bbl. crude oil price increase. It is possible, OPA said, that a determination of the overall refiners' position will be available before the temporary increases expire.

Navy-Held Plants Reduced to Eight

NPN News Bureau

CLEVELAND—The list of oil properties still held by the Navy as a result of strikes last October has now dropped to eight and the office of Vice Admiral Ben Moreell this week intimated that the number of facilities under naval control was expected to drop to three soon.

Refineries of Magnolia Petroleum Co., Beaumont, and Pure Oil Co., Smiths Bluff, Tex., were released to management March 1 and the Elk Refining Co. plant at Falling Rock, W. Va., March 2. Agreements had been reached earlier at Magnolia and Pure but ratification by the union was necessary before the plants could be released and during the past week the locals at these two plants approved the pacts. Terms were similar to those included in previous agreements.

Shortly before NPN press time Navy announced it would turn back to management on March 7 Texas Pipe Line Co.'s South Texas Division facilities.

Meanwhile approximately 85 employes of Taylor Refining Co., Taylor, Tex., went on strike last week, closing down the 22,500 b/d topping and cracking plant. According to the company, union demands 18% pay boost, shift differentials, reclassification of seniority and jobs and maintenance of membership. Company has been on 40-hour week since latter part of January and at that time a 10% wage increase offered by the company was accepted and put into effect.

However, in connection with the 10% increase, it was revealed by a company official that the union rejected a proposal for a profit-sharing plan. At the time the raise was accepted, the company further offered that when the company made a sufficient amount of money employes would be given a share in the profits "which the company hoped would be as great or greater than their demand."

Senate to Hear Independents at Hearing March 19

NPN News Bureau

WASHINGTON — Senate Petroleum Resources Committee has scheduled hearings on position of the independent company to begin March 19, and will conclude committee's study of petroleum resources in the U. S. in relation to national welfare.

Chairman O'Mahoney (D., Wyo.) said objective of hearings would be primarily to determine whether or not position of the independent company has been improved or injured as a result of the war and what recommendations, if any, committee should make with respect to government policy.

Texas Rejects B. of M. Request For Higher March Allowable

NPN News Bureau

WASHINGTON — Texas Railroad Commission has turned down Bureau of Mines request for a higher March allowable. At request of PAW, bureau had revised its estimate of March demand for Texas crude to 1,910,000 b/d—110,000 b/d more than called for in the Texas proration order.

Total U. S. crude demand for month was estimated, meanwhile, at 4,450,000 b/d, up 20,000 b/d from February.

Following is breakdown of B. of M. estimate of crude demand by states, compared with February forcasts:

State	Forecast March 1946	Forecast February 1946
Texas	1,910,000	1,890,000
California	838,000	844,000
Kansas	252,000	254,000
Oklahoma	366,000	368,000
Louisiana	372,000	368,000
Illinois	198,000	198,000
New Mexico	98,000	96,000
Wyoming	94,000	94,000
Arkansas	76,000	74,000
Mississippi	52,000	49,000
Michigan	46,000	46,000
Pennsylvania	33,000	33,000
Kentucky	29,000	29,000
Colorado	23,000	24,000
Montana	20,400	20,400
Indiana	13,000	13,000
New York	13,000	13,000
West Virginia	8,200	8,200
Ohio	7,000	7,000
Nebraska	800	800
Other	600	600

Pauley Confident as Probe Gets Set to Reopen; Indicates Rebuttal Will Take At Least 2 Weeks

NPN News Bureau

WASHINGTON — Confidence, unshaken by weeks under fire, continued to exude from Edwin W. Pauley this week as the nominee for undersecretary of the Navy bided the time when the opposition will have completed its case against his confirmation before Senate Naval Affairs Committee.

Steadfastly meeting reports that he could not be confirmed now with the declaration that he had been advised to the contrary, he indicated his rebuttal will take at least two weeks and he will devote "two years if necessary" to it.

After the committee recessed March 1 until March 6 "so Congress might read the record and study it and Mr. Pauley might have an opportunity to prepare his statement in rebuttal," he observed that there wasn't "a landslide" in the Senate in his favor but his chances were improved, if anything.

Testimony during the last few days had tended to refute early assertions that California Standard had "bailed" his Petrol Corp. out of financial difficulties about the time he allegedly switched from the side of the independents to that of the major interests in a California conservation bill fight.

Also, the credibility of an opposition witness, John A. Smith, Los Angeles, had come under a gruelling assault in which the leader of the attack on Pauley, Sen. Tobey (R, N.H.) was moved to explain why some of the questions he has been asking were prepared by Norman Littell, one-time assistant attorney general, and why Mr. Littell, who had given damaging testimony against Mr. Pauley, "prepped" Smith for the witness chair.

Sen. Tobey was put on the defensive in moves by Sen. Tydings (D, Md.), chief Pauley champion on the committee, which were preliminary to an exhaustive cross-examination of Mr. Smith about a settlement of $42,449.80 he made in 1928 with California Standard after the foreman of his former Crude Oil Cleaning Co. plant at Huntington Beach, Calif., had been arrested for alleged diversion of oil.

Sen. Tydings drew from Mr. Smith, president of the Independent Petroleum and Consumers Assn., the revelations that:

1. Mr. Smith flew to Washington for the hearing in a plane owned by the Superior Oil Co., Los Angeles, in company with E. G. Starr, IPCA treasurer; was occupying the hotel apartment of William Keck, Jr., executive of Superior, and expected he would not have to pay for any of the accommodations.

2. Mr. Smith was a dinner guest of Mr. and Mrs. Littell the evening of his arrival, as were Senators Tobey and Brewster (R, Me.), Mrs. Brewster and Mr. Starr; discussed at the gathering the evidence he had to present, and was warned by Mr. Littell that an attempt might be made in the hearing to "smear you up" in connection with the oil diversion.

Littell Agreed to Help

Sen. Tobey, who related Mr. Littell had been introduced to him by Sen. Murdock (D, Utah), explained he asked Mr. Littell to assist him in the hearing on recalling the part Mr. Littell played in the Department of Justice in renegotiation of an Elk Hills, Calif., oil contract. Mr. Littell, he said, agreed for "no remuneration, but merely at my request, to help out a poor, struggling, ordinary fellow trying to help prosecute a case."

Mr. Smith, confronted with a purported confession by the oil cleaning plant foreman, identified as "C. R. Gurley," heatedly addressed his inquisitor:

"Let me say this, Sen. Tydings, that I never instructed that man to steal any oil or anyone else to steal any oil, and he is just a liar. I don't care what you have got in the way of papers."

He branded the statement, which recounted that he raised the foreman's pay from 75c an hour to $300 a month, as "ridiculous." It detailed that Mr. Smith knew how oil was diverted through pump and tank bleeders and discharge lines from tanks.

"In the first place," declared Mr. Smith, "there were no Standard Oil Co. tanks on this plant at all, and that indicates the whole thing is a frame-up."

Asked, then, why he paid California Standard anything, he replied, "Because they alleged that they had suffered a loss," adding that a Standard official demanded, "You will pay that or you will be arrested," and that:

"Mr. Himrod (his attorney) advised me in view of all the circumstances it would be better and more sensible to pay the demand even though it was far beyond all reason rather than to lose my investment in the plant and get financially involved with these purchase contracts and to ruin what was then, I hoped, a budding young business career."

Mr. Smith brought Mr. Pauley to his feet at one point in the questioning with the declaration that, "And as to the credibility of witnesses, let me say this; that as to the Standard Oil Co. and Mr. Pauley, both, they have paid fines to the State of California for stealing the state's oil, and they were convicted of it, and you are talking here about something that involved an employe."

"That," erupted Pauley, "is a dirty lie." He subsided immediately when reproached for speaking out of order by committeemen.

Cross-examination of Mr. Smith was interrupted to accommodate T. S. Petersen, a California Standard vice president, and Chet Crank, Los Angeles advertising man, who had been waiting some time to testify.

Mr. Petersen's testimony refuted implications made earlier by Mr. Smith and other witnesses that a partial liquidation of Pauley's Petrol Corp., in which California Standard acquired some assets, was linked with Mr. Pauley's alleged change of attitude toward the Standard-supported Atkinson (conservation) Bill in the state assembly.

By his presentation, Mr. Petersen corroborated testimony of H. D. Collier, his company's board chairman, who had put into the record a memorandum recounting that the acquisition of the Petrol assets was "confidential" as far as Standard's identity was concerned, and who had made it plain that the negotiations were carried out prior to the introduction, in 1939, of the Atkinson Bill.

The memorandum, put in company files at about the time of the deal (1938) by Ralph K. Davies, a California Standard vice president now on leave of absence as deputy PAW, revealed that Signal Oil and Gas Co. conducted the negotiations as though it alone were the purchaser because Standard had been unable to close with Petrol at a satisfactory figure earlier.

Mr. Petersen said he was "quite sure" the deal was so conducted as to conceal from Petrol people Standard's desire to obtain the property, that Mr. Pauley himself did not know of Standard's interest and that Standard never had advanced any money to Petrol.

Mr. Crank, who said Petrol had been a client of the advertising agency bearing his name, contradicted implications

Denies 'Theft' Charge

NPN News Bureau

SAN FRANCISCO — Standard Oil Co. of California denies it ever paid a "fine" for "stealing" state-owned petroleum, in a statement controverting testimony of John A. Smith, California oil man, before Senate Naval Affairs Committee. Mr. Smith made his assertion at the hearing on the nomination of Edwin W. Pauley for under secretary of the Navy.

"Standard of California did not pay any fine for 'stealing' oil from the state of California, nor was it ever so charged," said the company's statement.

"Several years ago the company did make a settlement with the State of California for oil produced from six wells at Huntington Beach. The state at the time even admitted this company had trespassed unintentionally into state tidelands when wells drilled on a narrow strip of leased land deviated from true to state property, without the company's knowledge or ability to ascertain the fact."

in early testimony that members of the California assembly had been on the Petrol or Pauley payroll while serving as legislators.

Employed 2 Assemblymen

Mr. Crank said he had employed two assemblymen, John W. Evans and Cecil R. King, for public relations work for his Petrol account at $200 a month from Sept. 1, 1939, to March 30, 1940. He added that members of the California assembly receive only about $1,200 a year and "would starve" if they didn't have business connections or activity aside from legislative duties.

Further, Sen. Tydings brought out that the Atkinson Bill was passed in June, 1939, and that the services of Mr. Evans and Mr. King were in connection with marketing problems like changing of service station driveway locations, placement of signs, moving of telephone poles, etc.

Mr. Starr, on the other hand, echoed assertions by Mr. Smith that Mr. Pauley was active with them as a member of an organization of independents opposing the Atkinson Bill up until about two weeks before it was passed, then worked for the measure with Harry March, vice president and general counsel of Signal; Mr. Davies, J. Howard Marshall, now president of Ashland Oil and Refining Co., and others.

Mr. Smith and Mr. Starr declared Mr. Pauley was the governor's "oil adviser" or "controlled" him in oil matters, and the governor reversed his stand on the bill from promising a veto to listing it as a legislative "must."

In the legislative storm which ensued, said Mr. Smith:

1. Lobbyists for the Atkinson Bill became so thick in the chamber they were ruled off the floor but "dragged" members of the assembly to a porch to continue their persuasion.

2. Call of the house was invoked, with the clock stopped, and members, not permitted to leave to eat or sleep, became ill in a 30-hour session and had to be taken to hospitals.

Mr. Starr, president of Universal Consolidated Oil Co., Los Angeles, termed Mr. Smith's description of the episode "a very accurate one excepting that he was rather tame; I consider it one of the blackest pages of California's assembly history."

Admitting he knew of "nothing improper" in Mr. Pauley's asserted change of attitude, he said, "I feel he deserted us when he made a deal with the Standard Oil or one of its subsidiaries or concubines."

He explained he was referring to the 1938 deal by which Standard acquired Petrol's marine terminal and producing properties on Gato Ridge and Coalinga Nose and Signal acquired remaining assets.

Terms Pauley a Spy

"Mr. Pauley, when he was on our side, up until the time that he deserted us," Smith charged, "was, then, planted there and was a spy."

"Now," asked Sen. Tydings, "who planted him?"

"If he had sold out to Standard Oil or one of its subsidiaries or to Signal, he was planted by the purchaser," replied Mr. Starr.

When it was suggested he simply was voicing an opinion, Mr. Starr continued:

"Now if he did not sell out until approximately June 1, then he sold out on us, because he was with us at the start. That was his privilege."

Mr. Smith had testified he first learned of Mr. Pauley's alleged change of attitude in a conversation with him in a San Francisco hotel. Mr. Pauley told him, he said, that he had become convinced the Atkinson Bill could not be defeated, and observed he always had felt that, if he were on a sinking ship and a life preserver was available and he didn't use it, "I'd be a damn fool."

Further, said Mr. Smith, Mr. Pauley told him his "only alternative was bankruptcy," and asked him, "What are you fighting for and what do you want out of it?" Mr. Smith said he construed that to be an inquiry as to what his "price" for getting out of the fight would be.

Mr. Pauley interrupted his recital with the declaration, "No such conversation—" but was cut off by Sen. Tobey who insisted he make any statement later and in order.

Mr. Starr related he had a similar encounter with Mr. Pauley: "I said, Ed, what the hell has happened to you? 'Gene,' he said, 'you know my condition, and I have a chance to bail out. I was on a sinking ship and I grabbed a life preserver.' "

Pressed by Sen. Saltonstall (R, Mass.) as to whether there was anything improper in Mr. Pauley's purported reversal, Mr. Starr responded, "I didn't admire the method in which he changed his mind."

"But you know of nothing improper?"

"I conclusively do not—anything improper."

Mr. Pauley has contended throughout that he consistently supported the Atkinson Bill, opposing one known as the Sharkey Bill, and that only a small minority of independents opposed the former.

In examination of Mr. Petersen, Sen. Tydings struck at "things used to smear Mr. Pauley" in the press and radio. Some of these related to a meeting between Sen. Tobey and Mr. Petersen and Ned Burnham, a Washington representative of California Standard, in the New Hampshire senator's office—information about which "leaked" to Signal's Harry March before he was called to testify.

Mr. March, it had been brought out, had telephoned Mr. Petersen to say he had learned Mr. Burnham had been in to see Sen. Tobey and also that he "didn't see any reason why Standard Oil Co. should enter into this fracas and mixup of the tidelands with the Pauley hearing."

Sen. Tydings inquired of Mr. Petersen if it were not "a complete fraud" that, on his subsequent arrival at Mr. March's hotel apartment, he was greeted with "Et tu Brute?"

"Yes," agreed Mr. Petersen, "Mr. March didn't make that statement."

Neither, said the witness, was Mr. March "in a hell of a state of mind," as had been suggested by Sen. Tobey. Mr. March was "obviously disturbed," Mr. Petersen said, but felt otherwise after he pointed out that his (Petersen's) talking with Sen. Tobey after his company's name had been brought into the hearing was a natural and obvious thing for him to have done. He explained also to the committee that Mr. March needn't have been exercised about the fact Mr. Burnham talked to Sen. Tobey because Mr. Burnham "had no contact" with either tidelands matters where Standard was concerned or its Signal account.

Sen. Tydings continued: "It has likewise been testified heretofore, largely by Sen. Tobey through the medium of alleged questions, that in that conversation between you and Mr. March, Mr. March told you all that you had told Sen. Tobey. Did he or did he not tell you at your first meeting what your conversation was with Sen. Tobey in his office?"

"He couldn't have done that, Sen. Tydings, because I came almost (immediately) from Sen. Tobey's office to Mr. March's office (apartment)."

"That," declared Sen. Tydings, "was another fiction that went through all the press in big headlines like the $35,000 (campaign fund) pressure story put on Mr. (William A.) Patterson (president of United Air Lines), who, after it had been run through the press and over the radio two days, came here and testified that no suggestion ever made to him by Mr. Pauley was improper. I am quoting his exact word 'improper.' Do you know how we can get that corrected so the public can get the truth about this thing?"

Mr. Petersen said he was at a loss to suggest a means.

"You have likewise testified here," continued the Maryland senator, "that the arrangement between Signal Oil and Standard Oil was designed to keep the Petrol people, which was Mr. Pauley's company, from knowing that Standard Oil was behind the desired purchase. You are certain that that was the reason for this particular mechanism, which is a proper one?"

"That is my very definite opinion, Sen. Tydings," replied Mr. Petersen.

In questioning Mr. Smith, the Marylander brought out that the independents in the Atkinson Bill fight had a fund of about $400,000. Also, he produced a document purporting to show that the Superior Oil Co. contributed $78,607.75.

Krug Sets 'Least Possible Government' as His Goal as Interior Department Chief

No Questions About Oil Asked as Senate Committee Hears Nominee Discuss His Views on Public Power

NPN News Bureau

WASHINGTON—J. A. Krug, whose nomination as Secretary of Interior was speedily confirmed by the Senate this week, told the Senate Public Lands Committee during the brief hearing on his qualifications that he believed that government best which governed least, and intended to conduct affairs of the Interior Department in that fashion, regardless of what happened to the department.

Mr. Krug said his philosophy was to let the economy operate as freely as possible and as rapidly as possible, and to assist rather than direct private enterprise. He also expressed faith in the "collective common sense" of the people, and said he thought government administrators should seek the counsel of the people's representatives — senators and congressmen—on important policy matters.

No one asked to be heard by the committee, and no questions concerning oil were asked, but the senators present probed extensively into Mr. Krug's views on public power and on development programs, before going into executive session to approve his nomination.

J. A. Krug whose nomination as Secretary of Interior was confirmed by the Senate this week

Discusses TVA Experience

Sen. Johnson (D., Colo.) said the west was alarmed by Mr. Krug's past association with the TVA and afraid he was prejudiced in favor of regional (resources planning) authorities. Particularly disturbing, Sen. Johnson said, was the fear that he might decide to use water now used for irrigation purposes in development of power projects.

Mr. Krug replied that his experience with TVA was one of the "most inspirational" experiences in his life , but he didn't necessarily think regional authorities were the only means of developing each section of the country.

"I feel strongly that TVA was a sound way of developing that area," he said, "but I wouldn't know about other sections of the country until I had made a study of them. I think the nation's resources should be developed on a pattern which takes into account all factors."

Sen. Johnson reminded the nominee that the west was dependent on reclamation, and said he hoped Mr. Krug would not be prejudiced against the reclamation approach.

Later, under questioning by Sen. Murray (D., oMnt.), Mr. Krug said he saw no reason why irrigation, hydroelectric power or flood control programs should be developed separately, except where developing an area as a whole would result in such a complicated program that it would not be advisable. He emphasized that he did not believe the result of his experience with TVA should be applied to all sections of the country.

Sen. McCarran (D., Nev.) asked if Mr. Krug's TVA experience indicated private enterprise should be forced to compete with public power projects. Mr. Krug said no, but pointed out he was a firm believer in public power and would administer the public power laws "enthusiastically."

Mr. Krug contended, however, that in every case he thought public power could be introduced as a supplement to private facilities in such a way as not to put the private enterprise out of business.

He told the senators he would feel himself bound by the wishes of individual communities on power projects, although from a federal standpoint he did not believe government should enter the field unless it could supply power as cheaply or cheaper than private enterprise and unless it would help to develop the region.

Sen. Cordon (R., Ore.) inquired what Mr. Krug meant by his statement that he would administer the public power laws "enthusiastically."

Would Not 'Evangelize'

Mr. Krug said he could not promise that he would not refer to his TVA experience from time to time, but did not feel it would be his place to "proselyte" or "evangelize" with local groups.

Sen. McCarran asked if he had any experience in mining or agriculture, which the Nevada senator called the west's two biggest problems.

Mr. Krug answered that he had no direct experience, although he had considerable dealings with Intrior Department bureaus such as Bureau of Mines, Reclamation Bureau, and Bonneville Power Administration during his days as WPB chairman.

The Neveda senator also inquired about Mr. Krug's policy on development of minerals, and on establishment of national parks. The nominee said he felt a program was needed to develop minerals "for the future of the country," although imports of certain items—such as tin—would be needed.

About the parks, Mr. Krug said he would be "tempted" to establish some as former Secretary Ickes had done, but believed it was up to Congress to determine policy and his job to carry out that policy.

Sen. Willis (R., Ind.) asked if Mr. Krug had any private interests in oil, mining, or public utilities. Krug said "No."

Oil Men Term Krug 'Competent, Tough, Honest and Fair'

NPN News Bureau

NEW YORK—Appointment of J. A Krug as secretary of the Interior met with virtually unanimous approval from members of the petroleum industry here. Adjectives like "competent, tough, honest, and fair" were common in describing the new appointee.

Oil men who served in Washington during the war were inclined to discount tales of frequent battles between Mr. Krug and officials of PAW. A PAW alumnus said:

"The 100-octane program needed a tremendous amount of critical material. So did every other wartime activity. Hence Krug clashed often with Deputy PAW Davies and everyone else high up in the organization. That was only natural when each man had to place his own assignment above all others. But I don't recall anybody who bore a grudge against the WPB chief."

This sentiment was echoed by Max B. Miller, who was director of PAW Construction Division from April, 1940, until July, 1944. Stories have fattened on reports of many conflicts between Mr. Miller and Mr. Krug when the former was seeking to expedite the 100-octane program. Mr. Miller belittled these legends this week.

"Krug's a good man," he said. "He did a swell job in distributing electric power all over the country.

"Sure, there was a continual battle between PAW and WPB, just as there was between WPB and the Army and Navy. We fought for what we thought we ought to have, and they gave us what they wanted to. But there weren't any lasting hard feelings afterward. Krug's an excellent administrator."

Will Your Price Supervision Protect You Against the Battle for Gallons Now Starting?

REPORTS indicate that the battle for gallonage, almost regardless of the cost, has begun again. Judging from some of these reports one might be led to conclude that top sales management is so busy getting after more business and putting its distribution machinery and equipment in better shape, that it is paying little attention to what some of the boys are doing with their prices. These long war years, with shortage of supply and prices firmly up against the ceilings, have not required any price supervision by top executives. So at the moment one imagines that these executives are looking the other way from prices.

The first break in oil industry prices came late last Fall when some of the small western Independent refiners who had passed up their old customers for the steady cash business of the government, tried to get those jobbers back. These refiners found the jobbers had made new connections which were quite satisfactory and also were not inclined to think well of companies that had left them in the lurch when better profits appeared elsewhere. Instead of trying to work out some kind of a sales proposition that might get these jobbers back, or that might create new outlets, these refiners and their salesmen began slashing prices, one against the other. But their old jobbers were quite firmly anchored to their newer suppliers.

Several of these unsuccessful refiners have closed down because they could not find buyers at almost any price for their products, which were surplus on the market. In the meantime the other refiners, large and small, being able to sell their output through their regular outlets did not reduce prices, or if they did, only shaded them. These last refiners were selling not just gasoline but brand names, large scale advertising and merchandising and management plans. The unbranded refiners in cutting their prices were simply getting back to their old price level under that of the branded refiners. During the war they had been enjoying the same top prices as had been established by OPA on the basis mostly of branded goods, even though OPA selected as its ceiling the "lows" of the market instead of the "average" of high and lows on which most contracts were based.

The sagging tank car market has tended to bring price cutting to every one's mind. One hears of sales, even by majors, at less than their usual price even to competing jobbers in order to get new gallonage. Just what extenuating reasons there may be, investigation so far has not disclosed.

The weakening price situation also could suggest to top executives that they take a renewed interest in their pricing machinery. Perhaps some old price controls were abandoned or got rusty during the firm price days of the war.

Pricing practices of oil companies have improved greatly in the past dozen years, but even so the control of a company's pricing practices cannot be too intelligent. In the past, too many companies, large and small, priced to get gallonage instead of to get profits. Their thinking has been so sloppy that when the profits have been given away, then everyone would complain about that impersonal thing called "the market," forgetting the part each had in it. All would sit around and argue that they could not raise their own price even a little bit until "the market" advanced. None would do anything to help get that "market" up.

With costs rising as they are these days, with labor's inefficiency if anything increasing, with prospects for less gallonage to be consumed, due to strikes and delay in getting new cars and trucks back on the road, this is obviously no time to let operating margins be reduced by "get the gallonage" policy or through failure properly to supervise the making of prices. Well, before summer has come every oil company will need every fraction of a cent in today's prices. From present indications OPA may be continued and OPA may also continue its entirely unjustified ceilings on oil prices which is all the more reason for everyone trying to hold onto today's prices.

READERS' comments and opinions will be much appreciated by Warren C. Platt, NPN's Editor and Publisher, Penton Building, Cleveland 13, Ohio.

Weakening Oil Prices Warrant Fight to End OPA at Once

IT IS time for the oil industry to tell its members of Congress that there no longer is need for OPA control over oil prices. The industry has been suffering from surpluses of most products for some months. Prices are dropping even below the low wartime prices.

General Counsel Russell B. Brown, in his recent weekly report to President B. A. Hardey of the Independent Petroleum Assn. of America, calls on the oil industry to tell its story right now, it perhaps being the last chance to make effective remonstrance for another year. The IPAA expects to ask release for oil from OPA at the present hearings of the House Banking and Currency Committee which is considering the bill to extend OPA for another year.

Mr. Brown calls attention to quotations from four men, three promising release of price control when an industry gets into balance on supply and demand. Those three men are President Truman, Director Snyder of War Reconversion and Chester Bowles himself, his last statement being as recent as Dec. 6, 1945. The fourth quote is from Marriner S. Eccles, chairman of the Federal Reserve System who was testifying that controls should be removed when "supply comes into balance, or reasonable balance, with demand."

"I feel we should all move at once to make our views known, if we are really concerned with ending the ability of OPA to interfere with the welfare of our industry" said Mr. Brown.

WASHINGTON—By Herbert Yocom

A Question: Are Senate Probers Gunning for Pauley or Hannegan?

WASHINGTON — Unless they are holding something back, the Pauley probers would seem to have failed miserably thus far in their efforts to prove the existence of a "second Teapot Dome scandal."

Mr. Yocom

They have called in first this witness and then that, and not one of them—aside from the since-repudiated Mr. Ickes—has produced a single bit of testimony that is really entitled to respectful consideration.

Why then do they continue to occupy the time of the Senate Naval Affairs Committee with what is fast degenerating into a farcical and disgraceful performance? The answer, we think, is fairly simple, provided one has a proper understanding of what is behind this whole affair.

First, however, let it be said that we sympathize with the desire of Mr. Pauley to fight this thing through to the bitter end. Granted that the President may have been a bit naive in thinking that all others would believe as he that an oil man is as much to be trusted in high public office as any other American, Mr. Pauley's character and honesty have been severely impugned and it is understandable that he should want to try to clear his name. He regards himself as an honorable man; honestly believes that he would make a good undersecretary of the Navy. Accordingly, he is in the fight to stay and more power to him.

Now, as to some of the background. Where, for instance, does Sen. Charles Tobey of New Hampshire come in, and who is helping him in the staging of this cheap show?

Tobey, of course, is a Republican although sort of a leftish one, and naturally the GOP is more than willing to make all the political capital out of this affair that it can. He protests, however, that he is "alone, absolutely alone" in his battle against Pauley's confirmation, so where does he get his help?

Well, one of his allies is the St. Louis Post-Dispatch which last September first published the report, on a "leak" to it from the Interior Department, of what Mr. Ickes was later to describe as the "rawest proposition ever made to me," and which since then has been hot on the scent of "another Teapot Dome" involving the California tidelands, Mr. Pauley and, quite accidentally of course, an old P-D foeman by the name of Bob Hannegan, now Democratic National Chairman. So closely are Tobey and the P-D allied, in fact, that a P-D reporter generally is to be found close to him at the committee hearings and is frequently seen passing notes to the senator, apparently for the purpose of suggesting questions to be asked of the witness who happens to be on the stand at the moment.

Maybe, like the President, we're a bit naive, too, but could it just be that the Post-Dispatch, in fighting Pauley through Tobey, is really shooting at Hannegan?

Also working hand in glove with Sen. Tobey is Norman Littell, a somewhat puzzling character who has real reason for being sore—not so much at Pauley as at Standard of California. Now, that may seem strange, but it really isn't at all when you remember that Mr. Littell is an ex-assistant attorney general who left the Justice Department rather precipitately a couple of years back during the row over the first Navy Department-California Standard contract for producing crude from the Elk Hills Naval Petroleum Reserve.

Certainly Mr. Littell is interested in the Pauley nomination, and why shouldn't he play host at dinner to Sen. Tobey and to John A. Smith, of the Independent Petroleum and Consumers Assn., of California, and why shouldn't he also allow Smith to make his office his headquarters during his stay in Washington? You see, not only does Smith not like Pauley—because Pauley swung over to support of the Atkinson conservation bill in the 1939 referendum fight in California—but he also does not like California Standard, because it too favored that measure and because there's that memory of having had to pay $42,-449.80 to Standard back in 1928 for a little matter of 30,000 bbls. of crude which was "misdirected" into other channels while passing through his crude cleaning plant at Huntington Beach.

A lot of other funny people are in on this affair, as well. There's the left-wing political crowd from Southern California, for example, which includes such as Rep. Helen Gahagan Douglas and which resents the fact that politicos of the Pauley-Hannegan type are wresting control of the Democratic party from the New Dealers.

They are in the Pauley show up to the hilt, accordingly, and much of the "ammunition" that is being hurled against the nominee originates in their camp.

Don't mistake us. As was pointed out here once before, if there was anything done that was wrong we think that it ought to be spread on the record for all to see. But we do believe, in all sincerity, that fairness to Mr. Pauley requires an understanding of the motives which may prompt some of those who now come forward to protest his fitness for public office.

MIDWEST—By Earl Lamm

Mail Order House Takes on Midcontinent Solvents

DES MOINES, IA.—Here are some stories and bits of news heard at the Iowa Independent Oil Jobbers' Assn. convention here last week, which show what "We in Iowa" are thinking.

Mr. Lamm

Secretary Gienapp said the Iowa association was going to put out an annual gallonage report, beginning with 1945. Work of compiling it is to begin immediately.

Sears, Roebuck & Co. has taken on Midcontinent solvent oils for nationwide distribution for year. California was the first time this the proving ground for about 16 months previous, said A. A. Lauria in Chicago, buyer at Sears' headquarters. Prior to 1945, Sears pushed Pennsylvania Grade oils for some 15 or 18 years. Price of solvents is "about 5% to 6% higher" than Penn Grade on the volume Sears buys. Guesses made at the Iowa convention on the Sears annual volume ranging from 10,000,000 to 19,000,000 gal. "could both be right," Mr. Lauria said.

Story in trade sources is that when Sears decided to take on solvents, their large competitors in auto service stores attempted to do the same thing but couldn't find enough supply. C. W. Benson, buyer for Montgomery Ward & Co., Chicago, said last Saturday that he is now preparing to take on distribution of solvent oils because of insufficient supply of Penn Grade. They have been testing solvents in California for the past nine months.

* * *

Iowans are looking for a big spending spree by the State Highway Department as soon as new road machinery is available. Accumulated gasoline tax funds have built up fat bank accounts in various states. "We should watch to see that the money is spent wisely," Al Gienapp, secretary of the Iowa Assn., cautions.

* * *

Iowa jobbers want to kill OPA for the asserted reason that tires and other equipment they need badly and want to

buy, cannot be had "because it is being exported and sold at higher prices than OPA's domestic price ceilings." A jobber said he had just paid $1900 for a truck, which might not be worth more than $1200, but it's the only new one in his part of the country. Therefore, it's worth it, he said.

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At least one large supplier at Sioux City was reported to be selling gasoline to service station outlets cheaper than jobbers said they could buy it. The jobbers called it "another Detroit case." Our guess is that this report had considerable to do with passage of association's resolution endorsing the FTC decision in the Standard of Indiana case at Detroit.

Bids by suppliers on municipal, county and state contracts for gasoline in Iowa and elsewhere in the Midwest in many instances are reported lower than prices jobbers say they are paying for the same product. "Suppliers eager for this government business," said jobbers, "know they have to bid low in the open competition or lose out. Looks like jobbers on contracts are being stuck."

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With ambitious sons coming home from the war, co-op men are faced with a difficult problem. "If development of co-ops keeps up," one Iowa father who works for a co-op told a friend, "my boy's future is very limited. He will be unable to engage in business for himself because there wont be any. So all he can look forward to is working for a co-op."

When asked what the father did about it, the friend said: "Oh, the regional co-op gave him a better job and transferred him to. . . . . as manager of service stations."

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Jobbers who own their own bulk plants are worried about the "lend-lease" operations of big companies, who, say the jobbers, will set a stranger up in business in their midst by renting him a vacant service station or bulk plant for $1 a year or $25 a month, then sell him products at the same price charged jobbers who own their own equipment. Jobbers say that's not fair and that the big companies are entitled to a just return on their investment.

"Why tie up your money?" a jobber said a major company representative asked him. "We'll take your bulk plant off your hands and you can continue to manage it."

ATLANTIC COAST—By Frank P. S. Glassey

Bevin Tosses 'Welcome Mat' to Russians on Oil Treaty

NEW YORK — Failure of Soviet forces to evacuate northwestern Iran by March 2, as required under the Anglo-Soviet-Iranian treaty of 1942, coincided with an announcement that the Senate Foreign Relations Committee would postpone "indefinitely" hearings on the Anglo-American Petroleum Agreement which had been scheduled to begin in Washington March 4. Almost certainly there is no connection between the two events, aside from coincidence, yet their juxtaposition in the news is particularly interesting in view of a recent statement by British Foreign Secretary Ernest Bevin, hitherto unreported in this country.

Mr. Glassey

Secretary Bevin addressed the House of Commons on British foreign policy on Feb. 21. His speech received columns of publicity in leading metropolitan papers here including his offer to Russia to extend the Anglo-Soviet treaty for 50 years. The American press also carried London correspondents' accounts of Bevin's references to British-Russian differences in Iran. They did NOT carry, however, the fact that Bevin suggested that Russia join the Anglo-American petroleum pact, now awaiting Senate ratification. The text of his speech, just received here, reveals this rather provocative proposal.

Discussing British-Soviet differences, Bevin said:

"It is no use disguising the fact that amidst all these troubles there were the very vital interests of the United States, ourselves, and Soviet Russia in regard to oil, with which so much of our defense was concerned."

He then referred to a project for establishing a tripartite commission to settle Iranian difficulties, and added:

"One thing that must be done when a small country happens to possess a vital raw material is for the Allies so to arrange their business as not to make the small country the victim of controversy between the big Allies. I think that is sound policy; I tried to do it and failed. I can but apoligize for failure. At least I tried."

Then, referring to the United States:

"It is sometimes suggested that we 'gang up' against Russia. The difference in the position is that America and ourselves lay our cards on the table, and discuss our proposals and they range over a tremendously wide field. It is not merely a question of foreign policy when we are dealing with America, it is everything.

"During the last few months, we have dealt with the loan, we have dealt with Bretton Woods, we have arrived at an agreement on telecommunication, on civil aviation, oil and a whole host of settlements."

Now followed the significant sentence:

"I would be quite willing if the Soviet would join us in the oil agreement as an international agreement, because that would solve the conflict over oil as between the great Allies forever."

So far as this writer is aware, this marks the first occasion that any high official in either the British or American Governments has proposed inclusion of Russia in the oil agreement, which has already aroused so much controversy. Nobody here seriously believes that the Anglo-American pact hearings have been postponed to bring in Russia. In the first place, the agreement as now drawn would not apply to Russian oil interests; in the second, the United States would have to demand from Russia the return of American oil properties in Europe, confiscated by Soviet troops, before negotiating with Stalin on future petroleum policies.

The real reason for postponement of the Foreign Relations Committee hearings is probably the State Department's fear that they might be used to hold up the proposed loan to Britain. H. F. Sinclair, in a statement (see p. 10) indicates his belief that the entire matter of the Anglo-American agreement will now be abandoned.

Neverthless Bevin's statement titillates the imagination—particularly when it is recalled that Tom Connally, chairman of the Senate Foreign Relations Committee who has just returned to these shores, was in London when the British Foreign Secretary threw his bait on the waters.

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A week ago it was noted here that French purchases of lubricating oils from the United States are now running at an annual rate of about 200,000 metric tons (58,000,000 gal.). An influential British oil man now estimates that British purchases from this country are about twice that amount.

Dr. P. H. Frankel of Manchester Oil Refineries, currently visiting the United States, said that total United Kingdom prewar lube consumption was around 500,000 metric tons a year.

"Now," he added, "consumption is higher. Perhaps the annual buying of lubes refined in the United States is between 400,000 and 500,000 tons. The balance is obtained from home refining. The unknown factor is the supply obtained from Venezuela. Nobody outside official circles knows the exact amount of imports from Venezuela."

Navy and Oil Executives to Meet in Effort To Untangle Critical Fuel Oil Problems

NPN News Bureau

WASHINGTON—Navy Secretary Forrestal has asked 32 oil company presidents and other top executives to meet here March 8 to offer suggestions for remedying fuel oil stringency by voluntary industry action and discuss what supplies of Navy Special and 7-0-2 Diesel their companies might make available beyond present commitments.

Meeting has been called for 10 a.m. in Room 2907, Navy Building, with Secretary Forrestal and Assistant Secretary (For Air) John L. Sullivan in charge of department's oil affairs. Company executives may discuss possibilities of upping supplies in private if they so choose.

Secretary Forrestal's telegrams of invitation point out that Navy Special shortage is averaging about 47,000 b/d and Diesel, 23,000 b/d. They add that operational stocks of Navy Special will be exhausted by April 15 at present rate of withdrawal, and PAW has been unable to offer definite solution.

Estimated second quarter requirements are 270,000 b/d of Navy Special and 89,000 b/d of Diesel. During January, 203,000 b/d of former item were received from industry and 73,000 b/d were drawn from operational reserve stocks. February receipts were 233,000 b/d, while stock reduction was 51,000 b/d.

Navy invitation went out as OPA continued to labor on residual price increase recommendations made by Industry Advisory Committee, with no indications yet in sight as to when that agency might act, if at all.

OPA met March 5 with East Coast Fuel Oil Advisory group and again later with representatives of various federal agencies. Participants in latter session reported that not much of anything seemed to have been accomplished, although one upshot was that idea of clamping a temporary total embargo on issuance of commercial export licenses on heavy fuel oil probably will be abandoned, possibly in favor of some other method of holding down export volume. Just what this would be was not clear, however, although one source hinted that consideration was being given to a system of allocations.

On the price question, recommendations of the Advisory Committee were for adoption of following gravity scale for residual price ceilings: 85c per bbl. for Bunker C fuel oil of 10 degrees gravity and below, 97c for 10 to 12.9 degrees, $1.09 for 13 to 15.9 degrees, and $1.21 for 16 degrees and over. Responses for 30-odd Dist. 1 and Dist. 3 refiners polled by OPA as to effect such a scale would have on their operations was not encouraging, however, some reporting that it would help; others replying that they were already getting maximum residual yields.

Midwest Refiners, Marketers Oppose Fuel Oil Gravity Sales

NPN News Bureau

CHICAGO—Several refiners and marketers here and in Michigan are opposed to sale of fuel oil on a gravity basis as is being considered in Washington. They point out that this method failed once during the war, and OPA regulation authorizing it was cancelled. Fuel oil distributors say they are not interested in gravity, as flash, viscosity and cold test determine the heating value.

A refiner said that "gravity is a way of gypping the consumer." Solution for heavy fuel shortage, if any, he said is to make the price the same as that of road oil. Present ceiling on road oil is from 0.25c to 0.50c higher than on heavy fuel, he said and millions of barrels are going to road repair, for which he suggested cut back asphalt. Putting heavy fuel oil on gravity basis would stimulate use of large quantities of distillate for blends, and would add to shortage of those products. Also, he concluded, so many grades of small differentials on the gravity scale are unreliable and uncontrollable in establishing small price differentials of, say 0.50c.

Postpone Anglo-American Oil Treaty Hearings Indefinitely

NPN News Bureau

WASHINGTON — Senate Foreign Relations Committee again has postponed hearings on Anglo-American Petroleum Agreement, this time indefinitely, apparently to save State Department possible embarrassment in connection with British loan hearings starting Tuesday.

Acting PAW Davies asked postponement, upon request of State Department, March 1, after committee Feb. 28 had notified all interested parties that it planned to start hearings March 4, as scheduled. A PAW press release said, however, delay was requested "because State Department officials are currently pressed with other important matters."

Sinclair Hints Oil Treaty May Have Been Abandoned

NEW YORK — The Anglo-American Petroleum Agreement may have been abandoned entirely, and Senate hearings on the pact not merely postponed "indefinitely," H. F. Sinclair, president of Sinclair Oil Corp., indicated in a statement issued after Senate Foreign Relations Committee had announced postponement last Friday.

Text of his statement follows:

"What may be the last chapter in the troubled and mysterious life of the Anglo-American Petroleum Agreement was written Friday when Sen. George, acting chairman of Foreign Relations Committee announced that hearing on the proposal to ratify the agreement as a treaty, set for March 4, had been indefinitely postponed.

"Ralph K. Davies, who took up the task of putting over the treaty when Secretary Ickes retired, said that he had asked for the postponement at the request of the State Department which had not had time to study the agreement. Months have passed since Ickes and Davies brought back from London the revised agreement which has been well described as 'the same old girl in a new dress.' That is, a document just as dangerous and undesirable as the original agreement, so generally condemned that it had to be withdrawn.

"With due respect to all concerned, the reasons advanced for the abandonment of the Senate hearing to not hold water. Of the two principal and only really active promoters of the treaty, Ickes has retired, and Davies must have been aware that he would have faced on Monday a barrage of opposition from lawyers, state authorities, and representatives of the oil industry. And the need to explain—which no one has ever done—what the treaty really means and why any treaty was needed. If the Senate action marks the end of the attempt to run the oil industry under the mantle of a treaty it is 'good riddance to bad rubbish.'"

Form Committee to Study Transport Industry Problems

NPN News Bureau

CHICAGO — National Tank Truck Carriers, Inc., affiliated with American Trucking Assn., Washington, is forming an operating practices improvement committee to study industry problems. Chairman probably will be Frank Baird-Smith, manager, Refiners Transport & Terminal Co., Chicago.

Meeting of committee is to take place shortly after completion of membership appointments first of next week. On tentative agenda for discussion are elimination of confusion within industry on demurrage charges; uniform shipping papers; standard method for tank calibration; how best to improve service to shippers; trade barriers; how best to promote increased tank truck use; safety program.

Operators now hesitate to discuss uniform demurrage charges until action is taken on the Bulwinkle Bill pending in Congress, because of possible antitrust action. Bulwinkle Bill, which has been revised many times, if passed would permit operators to discuss tariffs. Some truck operators in Midwest now make variety of demurrage charges for loading and unloading delays over which they have no control, while other operators charge nothing.

Aurora to Get Cracking Unit

Special to NPN

DETROIT—Aurora Gasoline Co. has signed a license agreement with Universal Oil Products Co. of Chicago for installation and operation of a UOP improved fluid catalytic cracking unit, with design charge of 4000 b/d.

Further Modification in Indiana Standard Case Included in Proposed FTC Amendment

NPN News Bureau

WASHINGTON — Details of the amended order which FTC attorneys now propose for adoption by the commission were made public this week with release of a letter written by Walter B. Wooden, assistant chief counsel of FTC, to Albert L. Green, Standard Oil (Indiana) legal department.

Changes involve substitution of the term "such" gasoline for "branded" gasoline, elimination of provisos in numbered points of cease and desist order, and inclusion of a single section of provisos. FTC is awaiting a reply from Standard before filing formal motion for modification.

As now proposed, the cease and desist order would read:

This proceeding having been heard by the Federal Trade Commission upon the complaint of the commission as amended, answer of the respondent, testimony and other evidence in support of the allegations of said complaint as amended and in opposition thereto taken before a trial examiner of the commission theretofore duly designated by it, report of the trial examiner upon the evidence and exceptions filed thereto, briefs in support of the complaint and in opposition thereto, and oral argument of the counsel; and the commission having made its findings as to the facts and its conclusion that respondent has violated the provisions of subsection (a) of Section 2 of an act of Congress entitled "An Act to Supplement Existing Laws Against Unlawful Restraints and Monopolies, and for Other Purposes," approved Oct. 15, 1914 (Clayton Act), as amended by act approved June 19, 1936 (Robinson-Patman Act);

IT IS ORDERED that the respondent, Standard Oil Co. (Indiana), a corporation, and its officers, representatives, agents and employes, directly or through any corporate or other device in connection with the sale of gasoline in commerce as "commerce" is defined in the aforesaid Clayton Act, do forthwith cease and desist from discriminating, directly or indirectly, in the price of such gasoline of like grade and quality as among purchasers:

1. By selling such gasoline to competing purchasers at different prices in the manner and under the circumstances stated in the findings as to the facts herein.

2. By continuing or resuming the discriminations in price of such gasoline referred to and described in the commission's findings as to the facts herein.

3. By otherwise discriminating in price between purchasers of such gasoline in a manner and degree substantially similar to the manner and degree of the discriminations referred to and described in the commission's findings as to the facts herein.

4. By selling such gasoline to some retailers thereof at prices different from the prices charged other retailers who in fact compete in the sale and distribution of such gasoline.

5. By allowing a price to any dealer, jobber, or wholesaler on such gasoline sold by such dealer, jobber, or wholesaler at retail lower than the price which respondent charges its retailer-customers who in fact compete in the sale and distribution of such gasoline with such dealers, jobbers, or wholesalers in their retailing capacity.

6. By selling such gasoline to any jobber or wholesaler at a price lower than the price which respondent charges its retailer-customers who in fact compete in the sale and distribution of such gasoline with the retailer-customer of such jobbers or wholesalers, where such jobber or wholesaler resells such gasoline to any of its said retailer-customers at less than respondent's posted tankwagon price or directly or indirectly grants to any such retailer-customer any discounts, rebates, allowances, services, or facilities having the net effect of a reduction in price to the retailer.

For the purpose of comparison the term "price" as used in this order included discounts, rebates, allowances and other terms and conditions of sale.

The above specified requirements of this order are subject, however, to the following provisos:

(A) That none of the prohibitions of the order shall be taken as inhibiting any price differentials by respondent that were not found under the facts herein to have tended to injure, destroy or prevent competition among respondent's customers.

(B) That none of the prohibitions of the order shall be taken as preventing any price differentials by respondent which make only due allowance for differences in respondent's cost of manufacture, sale, or delivery resulting from the differing methods or quantities in which such gasoline is to such purchasers sold or delivered.

(C) That none of the prohibitions of the order shall be taken as inhibiting a lower price to jobbers than to retailers where respondent thereby makes only due allowance for its differences in cost of manufacture, sale or delivery resulting from the differing methods or quantities in which such gasoline is to such purchasers sold or delivered.

(D) That none of the provisions of the order shall be taken as inhibiting any price differentials by respondent that reflect differences in the grades and qualities of such gasoline.

IT IS FURTHER ORDERED that the respondent shall, within sixty (60) days after service upon it of this order, file with the commission a report in writing, setting forth in detail the manner and form in which it has complied with this order.

Sees Little Change in Order

CLEVELAND — The second proposed revision of the Federal Trade Commission order in the Standard Oil Co. (Indiana) Detroit case, announced this week at Washington, leaves unchanged the points to which the National Council of Independent Petroleum Assns. has objected in statements to FTC, according to Hubert B. Fuller, counsel for the Ohio Petroleum Marketers Assn., Inc.

Mr. Fuller said that he saw little significance in changes in the order, except possibly elimination of the term "branded" gasoline. This change, he added, probably was made to avoid misunderstanding.

Discussion of FTC Detroit Case To Highlight OPMA Convention

Special to NPN

COLUMBUS — Because of its far-reaching possible effects, including radical changes in established petroleum marketing operations, the cease-and-desist order issued by the Federal Trade Commission, involving certain operations of Indiana Standard in the Detroit area, is to be made a special subject for discussion at the annual meeting of Ohio Petroleum Marketers Assn., which will be conducted in connection with the 1946 convention of the organization at the Hotel Deshler-Wallick, in Columbus, March 12, 13 and 14.

Robert A. Warfel, executive secretary, said the intense interest among Ohio jobbers and distributors in implications of the FTC order had prompted directors of the association to depart from the usual custom of the association of restricting attendance at the annual meeting to the membership, and to open the doors to all convention visitors. The subject, he stated, would be presented by the association's president, Eric V. Weber, and its general counsel, Hubert B. Fuller, both of whom were active in preparing the statement, setting forth the views of independent groups concerning the order, which was submitted to the Commission by National Council of Independent Petroleum Associations.

Plans St. Louis Marine Terminal

ST. LOUIS—The Texas Co., has acquired river front properties in South St. Louis on which it plans to develop a marine terminal for handling of petroleum products. With tank storage for approximately 6,455,000 gals. of gasoline and other products and warehouse facilities to handle package stocks, all of which will represent an investment in the neighborhood of $500,000. Company states it will be equipped to serve not only St. Louis, but St. Louis marketing area.

Hadley Hopes for Peace in Marketing As Result of FTC's Detroit Order

Special to NPN

DES MOINES — The first analysis from the Detroit jobber's viewpoint of the Federal Trade Commission's decision in the Standard of Indiana case, was given at the Iowa Independent Oil Jobbers Assn. convention here Feb. 26-27, by Joseph D. Hadley, Executive Secretary, Michigan Petroleum Assn.

Text of Mr. Hadley's statement follows:

Now, we have heard all kinds of charges and counter charges about the underlying effect which this order is going to have on the industry, and some quarters have said that the jobber will no longer continue to exist. Briefs have been filed in opposition to the order by the respondent itself and by the National Council. I have not read the brief filed by the respondent, but I have studied to some extent the brief of the National Council. I understand also that the commission attorneys have now filed a motion to amend in a slight degree the order, and they purport to remove from the order the allowance of the ½c which was granted as a leeway. This, I believe, would be a good thing because the testimony of the case does not bear this particular point out. I noted that in the brief filed by the National Council it refers repeatedly to the "competitive petroleum marketing position" of the jobbers and "their ability to compete successfully with integrated companies in the sale of gasoline." The brief "emphasizes the importance of preserving the jobber s existence if free competition is to be maintained and the danger of centralizing marketing in the hands of a few integrated companies avoided." Actually there is no "free competition" between a jobber and his major oil company supplier, and cannot be in the very nature of the situation. The jobber is dependent upon his supplier for the gasoline he sells. Where the oil company distributes direct to retailers in the jobber's territory, obviously the jobber cannot compete for the business of his supplier's customers. If he attempted to do so the jobber would promptly find his source of supply cut off. It was brought out in this case that none of the Detroit wholesalers ever obtained the business of a single service station which had been purchasing direct from Standard.

It should be clear that in a territory such as Detroit, where the major oil companies sell their gasoline principally to retailers and have extensive distribution facilities for that purpose, the jobber selling the same gasoline exists only by sufferance and because his supplier has a reason for wanting him there. It was proved in this case that Standard does not offer the tank car deal to *any* retailer or retailers who are able to purchase in tank car quantities. Obviously it does not wish to sell very much gasoline at the tank car price when it can sell at a greater profit at the tank wagon price. When Citrin-Kolb first began to purchase in tank car lots it shared storage space with another jobber. When Standard found this out it told Citrin-Kolb that it would have to obtain its own separate storage tanks, because Standard did not wish to set any precedent for allowing two or more retailers to obtain joint storage facilities and receive tank car delivery.

Joseph D. Hadley, Detroit, executive secretary, Michigan Petroleum Assn., gives members of Iowa Independent Oil Jobbers Assn. at convention in Des Moines, his "I live there" opinion of FTC-Standard of Indiana case

The question may properly be asked, how does a major oil company profit by granting a tank car deal to one or two jobber-retailers in a marketing area, while refusing to extend the privilege further? The result in Detroit supplies the answer. The favored retailer cuts the price to get more business. This takes business away from other service stations, who are in turn forced to cut their price or lose sales. The result is a general price war among retailers, such as occurred in Detroit. The ultimate result is that dealers margins are reduced to the minimum at which even the more efficient dealers can operate a service station and make a living. Where dealers' margins are low the oil companies can raise the wholesale price accordingly. Thus, if the tank wagon price is 11c (plus taxes) and the dealer's margin is 4c, the public pays 15c for its gasoline. If after a price war the dealer's margin is reduced to 3c, the oil company can now raise its tank wagon price to 12c without increasing the price to the public. It is therefore to the advantage of the oil company to keep retail dealers' margins as low as possible.

A secondary result of this practice is that when dealers' margins are reduced many of the less efficient independent service station operators fail. The oil company can then acquire the service station property and put in its own lessee. If a lessee fails, his supplier can always find someone else who is willing to risk his savings in the gasoline business.

The brief filed states that unfair methods of competition will not be eliminated by the commission's order because local jobbers can purchase gasoline from refiners in other states not having distribution in the area. Theoretically it is true that a jobber in Detroit might obtain gasoline in tank car quantities from an oil company which does not distribute to retailers there, and resell such gasoline at retail at any price the jobber chooses. However, if the gasoline so purchased were a major brand, and the jobber cut the retail price in Detroit, that price would immediately be met by the other majors. The commission knows that all major brand gasolines sell at the same price per gallon in the same locality. If some major oil company not now represented in Detroit should enter Detroit through jobbers or otherwise and cut the price to the public, the public would benefit by the competition, but actually such a thing just won't happen. Standard is perfectly willing to permit its own retailers to be squeezed along with others in a price war instigated by the favored jobber; but it would never allow its gasoline to be undersold by another major brand.

We should not lose sight of the fact that Sun Oil Co. and Socony Vacuum Oil Co., Standard's two largest competitors in Detroit, do not engage in the practice of dual distribution in Detroit or elsewhere. Paul H. Harrison, Western Regional Manager for Sun Oil Co., testified as a witness for the commission that this practice is detrimental to the industry and that competitive conditions in Detroit would be improved if it were eliminated.

Boiled down to simple fundamentals, the decision becomes an excellent lever against discriminate price cutting. True, in accomplishing its mission, it sets up a formula whereby a jobber who happens to also operate retail stations must pay the tank wagon price for the gasoline which goes to his retail stations. I certainly don't have to tell you how to remedy that particular situation. All you have to do is lease the stations out to the operator so that you are then selling him as a dealer.

We, on the immediate firing line in Detroit, see in the order a real hope for marketing peace. Since the order was issued, several stations which were selling major products at cut-rate returned to the prevailing level. The proof of the pudding is in the eating, and I can say to you that the result of this particular order in the Standard case marks the first step in accomplishing a good, sound, stabilized market.

Will Discuss Terminal Rules

MADISON—Motor Fuel Tax Division has called a meeting of marine terminal operators for 10 a.m. March 14, Room 270, State Office Building. Attempt will be made to clarify and strengthen some of the state rules and regulations governing terminal operations, tax division reported.

Iowa Independent Jobbers Endorse FTC's Detroit Decision

Resolutions Hit Various Trade Practices, Call For 'Death' of OPA

By Earl Lamm
NPN Staff Writer

DES MOINES—Iowa Independent Oil Jobbers' Assn., in nine resolutions passed during their two-day convention here Feb. 26-27, hit at various trade practices, government agencies and the co-ops, and endorsed the Federal Trade Commission's Detroit decision. A tenth resolution commended the Iowa State Gasoline Tax Department for a harmonious relationship, and offered co-operation in improving the state motor fuel tax law.

OPA should cancel price controls on petroleum now, the jobbers said, then after discussion, approved another resolution to kill OPA June 30, 1946, when the present price control authority expires, because reconversion is being hampered.

Briefly, the other resolutions call for:

1. Equal taxation and treatment of private business, co-operatives and government corporations.

2. Repeal of federal gasoline and lube oil taxes.

3. Support effort to lower rail rates on petroleum products.

4. Temperature corrections on shipments of products to be made on basis of 50 deg. instead of present 60 deg.

5. Opposition to supplying gratis, loaning or leasing of marketing equipment without proper return on the investment.

The association also adopted a resolution criticizing the price reporting publications for not showing the "true price at which actual sales are made." This writer, Chicago News Bureau representative of NPN, was present and was called on for comment. He said that if the association had any facts that showed *OILGRAM* prices to be out of line to let him have them at once. No such evidence was offered. This writer wired for the information on his return to Chicago and has received assurances from Secretary Gienapp that such information will be forthcoming as soon as he can get it together.

Favored treatment of the co-ops and government corporations by government came in for a round of discussion, including an address by Howard Berolsheimer, economist of National Tax Equality Assn. A resolution urging wider jobber margins was also proposed but voted down, "because we would be playing into the hands of the co-op, who now buy products cheaper than we do." If price controls are lifted as urged, the question of margins would be a matter for the industry to settle. Lower freight rates, if obtained, and publication of "actual" product prices were pointed to as possible help for the jobber in meeting his competition.

The convention, called a "Reconversion Oil Conference," was opened Feb. 26, by President Walter J. Mohler. Three speakers were presented—Warren C. Platt, Editor of NPN, Joseph D. Hadley, executive secretary, Michigan Petroleum Assn., and George C. Lloyd, executive secretary, Iowa Petroleum Industries Committee.

Wednesday, the resolutions were presented, officers and directors elected, and four additional speakers were heard—W. W. Vandeveer, president of Allied Oil Co., Cleveland, and former director PAW Dist. 2; E. J. Gallmayer, vice president, Wayne Pump Co.; Mr. Berolsheimer of National Tax Equality Assn., and Edwin F. Forrer, U. S. Employment registration officer, Des Moines.

Independent Free Enterprise

Mr. Vandeveer and Mr. Gallmayer, who followed him on the re-arranged program, portrayed an energetic, but as yet still only hoped for, independent free enterprise, which they said would soon saturate the market with merchandise and put the brakes on inflation. Then it would take salesmanship to sell, Mr. Gallmayer said.

Reselecting a principle of government —Republican or Socialistic—Mr. Vandeveer declared was the first problem facing the country. He urged the former,

The 1946 officers and directors of Iowa Independent Oil Jobbers Assn., elected or re-elected (*denotes re-elected) at convention in Des Moines Feb. 26-27 are (l. to r.): Seated—H. J. Zacharais, Red Star Oil Co., Oelwein, treasurer; W. J. Mohler, Schaller Oil Co., Schaller, *president; Ike Carnes, Carnes Oil Co., Clinton, vice president; A. C. Gienapp, Manchester, °executive secretary. Directors (standing) are: *Gerald Phippen, Russell Oil Co., Russell; *Martin A. Jenson, Mid-West Service Co., Algona; Robert V. Jacobson, Britt Oil Co., Britt; *John W. Schultz, Consumers Petroleum Co., Davenport; *H. P. Kruse, Marathon Products Co., Wellsburg; L. D. Tucker, Tucker Service Co., Knoxville. Directors not present when photograph was taken were: Ralph Kinnoman, Primary Oil Co., New London; Darrel Davison, Clarinda Oil Co., Clarinda; L. S. Brown, Brown Oil Co., Cherokee; °Gerhard Goplerud, Goplerud Oil Co., Osage

W. W. Vandeveer (left) president, Allied Oil Co., Cleveland, and E. J. Gallmayer, vice president, Wayne Pump Co., Ft. Wayne, Ind., discuss free enterprise at Iowa meeting

Posed on mezzanine at Ft. Des Moines Hotel are (l. to r.): R. C. McCalley, Deep Rock Oil Corp., Marion, Iowa, and K. P. Griggs, Griffith Oil Co., Wellman, Iowa

declaring it has brought America the world's highest standard of living. Departing from that principle by unsound political leadership, he said, produced wars, depressions, unsound labor and business policies—the co-ops for one.

"If the socialism of England and France, and the communism of Russia are so much better than America's republicanism with its free enterprise," he demanded, "why are those countries now trying to borrow large sums of money from us with which to buy goods we manufacture? That way we lose both the money we lend them and the goods they buy with it."

Asks Death of OPA

Referring to strikes, he declared that neither industry or labor is lily white, and that a labor policy should be adopted that would treat both exactly alike, making each carry its responsibilities. In opposing a planned economy, he said government bureaus have been reduced only 3% since V-J Day. He contended the life of OPA should not be extended beyond June 30.

"Many price ceilings should be removed now," he said. "The law of averages and competition will take care of the situation. Out here in Iowa," he continued, "where all the hogs eat their swill from the same trough, some get pushed around and are runts. The same will happen in business, but that's fair."

Build up Initiative

You cannot, he pointed out, bring about prosperity by discouraging thrift; strengthen the weak by breaking the strong; help small men by tearing down big men; help the poor by destroying the rich; keep out of trouble by spending more than your income; lift the wage earner by pulling the wage payer down; bring about peace and prosperity by inciting class hatred; establish sound security on borrowed money; build character and courage by taking away a man's initiative and independence; nor can you help men permanently by doing for them what they could and should do for themselves.

Mr Gallmayer declared that a good many oil marketing men have "Chinese arthritis—where blood in your veins turns to lead where you sit down. We've been selling in a vacuum," he continued, "but that vacuum is going to disappear suddenly one day."

He urged his audience to take pride in the petroleum industry, "for it's a wonderful industry," he declared, and suggested that they read the three articles in recent issues of NPN about poor housekeeping at service stations—the result of "Chinese arthritis."

"Salesmanship," he continued, "is an adventure in friendship. More orders are obtained through friends than any other way."

Formula for Success

His formula for success is—*Knowledge—Enthusiasm—Work*. "Make your men know where your oil comes from," he said, "how it is made and why it's better than the other fellow's. 'Here's your paper!' is salesmanship. 'Do you want a paper?' is not," he declared.

In his secretary's report, Mr. Gienapp reviewed wartime rationing and other government regulations, and cited instances where the association had been helpful in smoothing the road, guarding the jobber's margin and saved them money on freight claims.

"To my surprise," he said, "I still find some jobbers are compelled to pay chain store taxes, which tax has been declared unconstitutional by the courts. We are trying to get it straightened out with the Iowa Tax Commission."

Total of 36 active and six associates were added to the association's new membership roster during the past year, and 12 active and two associates dropped out. Finances were reported in good shape.

Robert D. Blue, governor of Iowa, welcomed the oil men at their banquet

W. K. McCulloch (left) field representative, and George P. Rosser (second from left), assistant division manager, Ethyl Corp., Kansas City, Ed. K. Stockfeld and A. O. Seifkin, (right) Searle Petroleum Co., Omaha, get together for a chat at Iowa Independents convention

Feb. 27. About 600 oil men and their ladies attended. B. L. Majewski, vice president of Deep Rock Oil Corp., Chicago, was the speaker. He expressed regret that the association did not approve a resolution calling for wider jobber margins. He also said that in his opinion no oil man should be undersecretary or secretary of the Navy, or Secretary of the Interior.

About 10 p.m., the curtain rang down on a five-act floor show.

Iowa Jobber Resolutions

DES MOINES—Iowa Independent Oil Jobbers' Assn. passed resolutions at annual convention here on Feb. 26-27 directed as follows:

Price Control

Asks that the life of the OPA not be extended beyond June 30, 1946, because price control is hampering reconversion.

Considers that continuation of price control in the petroleum industry is entirely unnecessary and favors its early elimination.

Leasing

Looks with disfavor on the uneconomic policy of leasing valuable property for less than a fair return on investment; the loaning or renting of equipment, or any other schemes of this nature which will only tend to reduce the standing of the petroleum industry in the opinion of the general public.

Taxes

Urges repeal of federal taxes on gasoline and lubricating oil.

Re-affirms desire to co-operate with the Gasoline Tax Department of the Iowa state treasurer and urges officials in charge of that department to call on the secretary, the officers or any member of the association for any assistance that it may be able to render in the formulation of plans or regulations designed to improve the application of the state's motor vehicle fuel tax law.

Asks that all government corporations and co-operative forms of business now in competition with private business, or hereafter formed, be subjected to all the rules and regulations of private business and be taxed in the same manner and pay the same taxes as private enterprise.

Temperature Correction

Requests temperature adjustments be lowered from 60 degress F. to 50 degress on invoiced volume on tank car or transport sales.

FTC's Detroit Order

Supports the Federal Trade Commission's decision in the Detroit case.

Rail Rates

Supports anv effort which has as its objective the lowering of the rail rates from Group 2, 3, 4 on petroleum products.

Kansas Distributors Hear Reason for New Fuel Levy

Special to NPN

WICHITA, Kans.—Between 250 and 300 members of the Independent Gasoline Distributors Assn. attended the organization's eighth annual convention held at Lassen hotel here Feb. 25.

All officers were re-elected. They are: Howard L. Parker, Security Oil Co., president; John B. Gabbert, Gabbert Oil Co., vice president; L. Vernon Johnson, Johnson Oil Co., secretary-treasurer; and Joe C. Alley, Thrift Oil Co., and George Betz, Asherville Grain Co., directors.

Stanley Taylor, chief counsel, Kansas Commission of Revenue, speaking on "The New One Cent Gasoline Tax-Expanded Highway Program," told the group that the tax increase, first assessment in the history of Kansas on fuel used by farmers, railroads, and airplanes, was necessary if the state is to rebuild and maintain adequate farm-to-market roads. Only with the aid of the additional tax can the state match dollar-for-dollar federal aid given Kansas in the national postwar highway improvement program, he added

Other speakers at the one-day convention included B. E. Mitchner, director of revenue, who explained to the group the forms for reporting the new tax; R. F. Sharpe, district manager, Firestone Tire and Rubber Co., who talked on "Your Outlook on Tires;" and Sen. Alex Hotchkiss, Kansas Legislative counsel, who spoke on "Your Business and International Relations."

Says Business Must Pass On Higher Costs Due to Taxes

NPN News Bureau

CLEVELAND—Citing an increase in taxation from 7% of the national income before the war to a rate of 31.4% of the national income today, John L. Marsh, executive secretary, Petroleum Industry Committee of Ohio, told members of Ohio Bottlers of Carbonated Beverages, Inc., here recently that taxes have become a booster of costs in business operation.

"Taxes influence higher costs from many directions," he pointed out. "A few years ago Congress made the salaries of all public employes subject to the income tax laws. Inevitably the states and local governments will be compelled to compensate them for their income tax payments. If it were otherwise, the public employes would suffer a serious reduction in their living standards.

"This compensatory process has already begun in Ohio. The last session of the legislature granted the school people an annual increase aggregating eight million dollars. Local governments are increasing the salaries of their employes.

". . . Where will the states and local governments get their funds with which to pay these increased salaries," he asked. "It can come from but one source—the earnings of people and industry—both being one and the same. So, because public salaries were taxed by one branch of government another burden is added to your cost of doing business by another."

Mr. Marsh then explained that taxes and new wage rates are applied to the things used in industry. Prices will be higher. Each of these extra items of cost per unit of production may be small but the aggregate of them all will be much greater than heretofore and large enough to produce business failures unless they can be passed on.

"It is not difficult, then, to imagine the headaches and heartaches which are being suffered by managers of enterprise everywhere because no one will be able to escape dealing with such problems. And few will be able through further efficiencies either to absorb or continue the traditional policy of reducing prices to the consumer," he asserted.

"Apparently we are going to step up onto a higher plateau of costs and prices and remain there for some time to come—at least until the next depression which will probably be more severe than any that have occurred heretofore, largely because we will have further to fall," Mr. Marsh warned.

Referring to gasoline taxation in conclusion, the speaker urged support of any effort to obtain an anti-tax-diversion amendment in Ohio.

Asks Public Support for Principles of Tax Equality

NPN News Bureau

CHICAGO—Some 48 million Americans required to file income tax returns by March 15 are urged to support the principles of tax equality in a statement issued by National Tax Equality Assn. NTEA said these tax payers will pay the Treasury nearly $20 billion in taxes on wages and salaries earned in 1945.

Homer E. Marsh, NTEA director, said this averages $410 per taxpayer. The Treasury, he added, will collect $16 billion from 450,000 reporting corporations.

"But co-operative corporations are allowed to escape Federal income taxes under Section 101 of the Internal Revenue code and mutuals pay little if any federal income tax," Mr. Marsh stated.

List Kansas Oil Men's Speakers

Special to NPN

WICHITA, KANS. — Eight speakers are scheduled to address Kansas Oil Men's Assn. convention when it convenes at Broadview Hotel here March 11-12. They are:

Gov. Andrew Schoeppel of Kansas; Alex Drier, war correspondent and news commentator: Warren Platt, editor, NATIONAL PETROLEUM NEWS, and war correspondent; R. S. Cargill, president, Victoria Elevator Co., Minneapolis; Barney Majewski, vice president, Deep Rock Oil Corp.; Paul Williams, Midwestern Refiner's Associated Research technical representative; John Baird, technical representative, Lubri-Zol Laboratories; Bert E. Mitchner, director of revenue; Al Schenkosky, chief, Kansas Motor Fuel Tax Division.

Man at the Pump Is the "Company" In Eyes of Public, Sneed Warns

Special to NPN

NASHVILLE, Tenn.—Speaking of "Markets of the Reconversion Period" before the Tennessee Oil Men's Assn. recently, E. R. Sneed, Socony-Vacuum Oil Co., St. Louis, stressed the importance to petroleum marketers of analyzing thoroughly their markets.

Pointing out that markets are static—continually changing in their quantity and quality of potential buying power—Mr. Sneed emphasized the need for vigilant observation and analysis.

Decentralization of city populations and the increasing habit of people in purchasing merchandise, services and entertainment at a convenient neighborhood trading area, predicts big growth of present and newly-promoted strategic, decentralized shopping centers, as soon as materials and manpower are available.

Service stations on the main intersections, or within or very close to these shopping centers, he explained, generally enjoy much better volume of sales, year in and year out, than those stations between and away from them. However, he warned, changes and improvements of main arteries should be watched.

Mr. Sneed then discussed the subject of "strategic site value" of service stations, pointing out that "a large percentage of service of filling staitons (because many of them are not service stations) cannot justify more than small upkeep expense. Inasmuch as they do not justify modern upkeep they will gradually deteriorate."

"This is a challenge to the ability, ingenuity and pride of every distributor. Each marketer, or distributor, by his own thinking, planning and his own works, will determine the plane, quality and quantity of his business and ultimate success," Mr. Sneed stated.

"What good is consumer research knowledge to the distributor who is selling his petroleum products through 'fair' to 'poor' locations, and with poor facilities? They do not justify a building and modern facilities that insure maximum customer satisfaction.

"While I expect to see many 'fair' to 'poor' filling stations from now on, I do maintain that the wide-awake distributor can and will always be improving his distribution to the simultaneous tune of better marketing efficiency, better consumer satisfaction, better profits and a whale of a lot more pride and fun," he told the oil men.

In conclusion Mr. Sneed said:

"If you have retail outlets, don't fail to secure for yourself and your helpers all of the service station training possible. This is one of the most important musts in the petroleum industry. The man at the pump is you, or your company. Full and complete knowledge of what, where, when and how to efficiently handle every major or minor operation in connection with servicing cars, builds confidence, business and profits. Education always pays dividends. Inefficient helpers and customer mortality are vicious thieves of sales and profits.

"Don't become so well acquainted with your stations that you cannot see defects or a sloppy appearance. The Dec. 1 edition of your 'Tennessee Industrial Planning Newsletter' said:

" 'The representatives of that new industry you need so badly will most certainly look at your town, and with very critical eyes. Are you proud of your town's clean, progressive appearance, or are you just a little ashamed of its run-down-at-the-heel stores, dirty and rutted streets, uncut courthouse lawn, smelly restaurants and unpainted homes.'

" 'Take a look' at your places of business, and spend some more of your profits to keep them attractive.

". . . . This year and on through the reconversion period, there will be spent in this country by travel-hungry visitors, many millions of dollars beyond our comprehension. I hesitate to mention predictions I have read about. Whatever the total might be, we do know that travel is a big industry and a tremendous market to cater to.

". . . . Today's smaller resorts will blossom into larger and thriving communities. Wayside services of all kinds—hotels, restaurants, theaters, nightclubs, apartment houses, lakeside and mountain homes and cabins—all will increase greatly in some areas of your state. Real estate valuations in these areas will rise. Some of the vacationers will move to Tennessee.

"Travel increases buying power and distributes it. Don't overlook preparing for your share of this market, as well as your local trade."

Topics of Interest to Oil Men Scheduled at SAE Aircraft Meet

NPN News Bureau

NEW YORK—Discussional planning to meet future engineering requirements of commercial and civil aviation in the U. S. features the program for SAE National Aeronautic meeting scheduled for April 3-5 in Hotel New Yorker here.

Program set forth by General Manager John A. C. Warner of SAE includes several topics of interest to oil men. They are:

April 3—Afternoon

"Performance Characteristics of the BMW 003 and a Comparison with the JUMO 004 Jet Engine for Aircraft," by W. G. Lundquist and R. W. Cole, Wright Aeronautical Corp., Paterson, N. J.

"Aircraft Gas Turbines with Centrifugal Compressors," by R. S. Hall, General Electric Corp., West Lynn, Mass.

April 4—Morning

"Fuel and Lubricating Oil Requirements for Personal Planes," by C. T. Doman, Aircooled Motors Corp., Syracuse, N. Y.

April 4—Evening

"Increasing the Utility of the Private Airplane," by W. T. Piper, Piper Aircraft Corp., Lock Haven, Pa.

April 5—Morning

"Fuel Sensitivity and Engine Severity in Aircraft Engines," by S. D. Heron, Ethyl Corp., Detroit.

"Utilization of the Exhaust Gas of Aircraft Engines," by Benjamin Pinkel, National Advisory Committee for Aeronautics, Cleveland Airport, Cleveland.

District Meetings of API's Production Division Set

NPN News Bureau

NEW YORK—District meetings of the Division of Production of API have been set. Vice President George A. Hill, Jr., says they are as follows:

Pacific Coast District — Biltmore Hotel, Los Angeles, April 11 - 12, B. P. Kantzer, Union Oil Co., Los Angeles, chairman.

Southwestern District — Washington-Youree Hotel, Shreveport, La. May 17-18, W. E. Winn, Sun Oil Co., Dallas, chairman.

Mid-Continent District—Skirvin Hotel, Oklahoma City, June 6 - 7, J. S. Montgomery, Oklahoma City, chairman.

Eastern District—William Penn Hotel, Pittsburgh, Pa., June 13 - 14, V. F. Bowyer, Peoples Natural Gas Co., Pittsburgh, chairman.

Program committees for the meetings are headed by M. W. Morris, Standard Oil Co. of California, Los Angeles, for the Pacific District; W. V. Vietti, The Texas Co., Houston, for the Southwestern District; H. S. Kelly, Phillips Petroleum Co., Bartlesville, for the Mid-Continent, and J. F. Swain, Huntley & Huntley, Pittsburgh, for the Eastern District.

Illinois Oil Assn. Meet Set

Special to NPN

MT. VERNON, Ill. — The newly organized Illinois Oil and Gas Assn., with Will I. Lewis, president, will have its first business meeting at 7:30 p. m., March 29, in the County Court House.

The association, reorganized from the former Indiana & Illinois Oil and Gas Assn., Robinson, Ill., has moved its headquarters to Emmerson Hotel in Mt. Vernon.

An election of officers and directors will be held and association will announce a membership drive.

Name New AMA President

DETROIT—George W. Mason, president, Kelvinator Corp., has been elected president of Automobile Manufacturers Assn. He succeeds Alvan Macauley, chairman of the board, Packard Motor Car Co., who resigned recently after an 18-year tenure in office.

George Christopher, president of Packard, was named to succeed Mr. Mason, who had previously been association treasurer.

MECHANICS

OF THE VISEGRIP CLOSURE FOR STEEL DRUMS

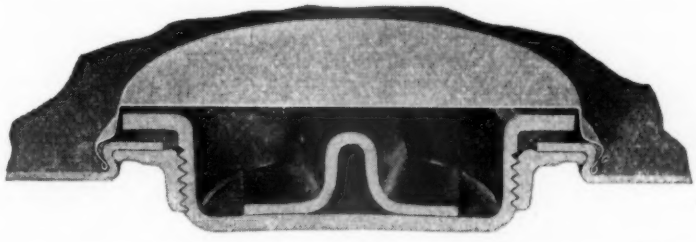
THE VISE is the simple, powerful mechanical basis for the VISEGRIP CLOSURE. The VISEGRIP CLOSURE matches the steel drum for which it is intended with *all-steel* construction, in flange and plug.

Ten-gauge steel is used in the VISEGRIP FLANGE. The coining action draws added strength into the collar for the five full cut threads. Precision manufacturing standards are maintained constantly.

Twelve-gauge steel is used in the VISEGRIP PLUG. Uniform dimensions, balance, high-quality finish and perfect gasket seat are maintained in the precision manufacture. Five full threads are cut and match those in the flange closely. The welded tightening lug adds strength and provides for convenient operation. The plug has holes for wire-sealing and may be cap-sealed.

The VISEGRIP CLOSURE is equipped with a standard gasket, the product of recent extensive research in synthetics, which is highly resistant to petroleum, aromatics, most chemicals, intense pressure and extreme temperatures.

The VISEGRIP CAP SEAL, equipped with an oil- and chemical-resisting gasket, will withstand internal pressures up to 60 pounds per square inch. It can be used on drums with shallow chimes without protruding above the chimes.



THIS is a section of a drum-head that is equipped with a VISEGRIP CLOSURE and a VISEGRIP CAP SEAL.

1—The flange has been forced into the drum metal; the drum metal has been drawn around the edge of the flange.

2—A flat gasket seat has been formed of the drum metal; the plug has a matching flat surface.

3—The threads in the flange match closely with those in the plug.

4—The vise-action, between plug and flange, is applied securely against the drum metal. The gasket fits closely around the plug and is secure in the vise, against drum metal and flange.

5—The cap seal clamps securely upon the drum metal, thereby creating a dual seal; the plug seals on the drum metal.

Drums that are equipped with the Mechanics of the VISEGRIP will be tight from filling point to emptying point. No leakage—No undetected tampering.

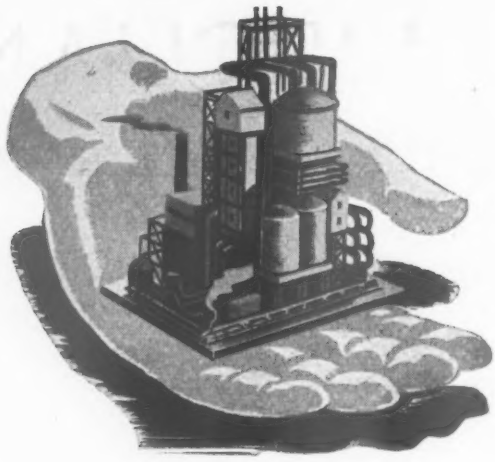
POSITIVE PRODUCT PROTECTION provided with

VISEGRIP CLOSURES *and* **VISEGRIP CAPSEALS**

developed and produced for more than twenty years by

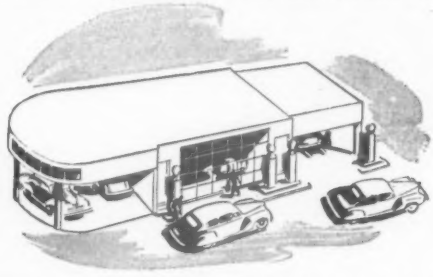
RIEKE METAL PRODUCTS CORPORATION

AUBURN, INDIANA NEW YORK, N. Y.



The Economic Feasibility of the Small "Cat-Cracker"

TODAY, of course, *Fluid* catalytic-cracking has become almost vital to every refiner determined to meet the quality standards required by current and future markets. But many's the question that arises on the feasibility of units in smaller capacities. Nevertheless, the issue must be resolved by refiners with a crude throughput even as small as 3000 to 5000 BPD.



For if no immediate capital investment is contemplated for a *Fluid* unit, there's every indication that the refiner has but these alternatives: 1. Make no attempt to meet competition on a quality basis; or, 2. Attempt to match competition via costly blending. As a temporary expedient, this latter can prove satisfactory, but it holds little promise over the long haul.

When the subject of investing in a *Fluid* unit is investigated, two schools of thought become immediately apparent. One, which we must dismiss in all fairness to the Kellogg philosophy of "There is no substitute for the best design," advocates the purchase of some form of catalytic-cracking at lowest initial cost available. The second measures the true economic worth of a *Fluid* unit – regardless of size – by its earning power. And this is the yardstick of the Kellogg approach to process design.

To the refiner who desires a *Fluid* unit with a capacity as small as 1,700 BPD... Kellogg can deliver designs that will match the biggest units it has built in quality of product and dependability of operation. While these two performance conditions are essential, ultimate earning power depends as well on other factors such as crude supply, market for products and the local competitive situation. Because these conditions differ so radically in various localities—and even within the same localities at different times—there is no one design, no single set of engineering principles against which a proposed unit may be

measured. Instead, careful consideration highlights again the fact that every individual refiner requires an individual solution to his problem.

However, for quick evaluation, probably the best surface yardstick of earning power rests in the flexibility of a *Fluid* unit . . . its ability to "follow the market" in product distribution and charge. Kellogg engineers design this flexibility into *Fluid* units in many ways. The effect that such design can have on overall operating results is readily apparent when you consider the possible variation in just four of the elements of design:

1. The ability of *Fluid* units to obtain optimum cracking on a wide range of charge stocks from reduced crude to light gas oil, which is an inherent advantage of the *Fluid* principle itself.
2. The possibility of varying the catalyst bed level in the reactor and changing the catalyst-oil ratio at will for optimum product distribution.
3. The necessity of maintaining catalyst selectivity at optimum value with controlled particle size—and with minimum replacement—for economical and efficient operation.
4. The selection of proper balance between external and internal thermal facilities for optimum flexibility and economy.

Here then is the crux of the economic feasibility of the small *Fluid* unit. *Ultimate earning power*—the true measure of value in any refining operation—*depends on designing into the unit the necessary engineering features to meet a specific competitive situation that exists now* . . . and to provide an inherent flexibility that will extend this competitive advantage into the foreseeable future. In other words—"There is no substitute for the best design."

THINKING IT THROUGH

NO. 2 IN A SERIES

PROPOSITION: **The inclusion of an efficient catalyst recovery system in a *Fluid* "Cat-cracking" unit is a sound investment.**

THE FACTS: The economic efficiency of a Fluid Catalytic-Cracking unit must perforce depend on the efficiency with which the catalyst itself is utilized.

If recovery is not carried out to the nth degree when utilizing today's accepted catalysts the fines are lost entirely . . . resulting in immediate reduction of catalyst surface exposed for reaction. Also, since catalyst cost is high, such loss is equivalent, in essence, to throwing money out of the window.

Further, the smooth operation of the whole system depends on catalyst content. When fines are lost surges occur through the system.

Such factors as these are ruinous to high stream efficiency and total throughput. And the revenue losses thus sustained through inefficient operation are far greater than the initial cost of a recovery system.

CONCLUSION: **THERE IS NO SUBSTITUTE FOR THE BEST DESIGN**

THE M. W. KELLOGG COMPANY

Engineers and Economists to the Petroleum Refining Industry

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Fear Case Bill Due for Drastic Revision in Senate Committee

NPN News Bureau

WASHINGTON — Senate Education and Labor Committee this week concluded hearings on Case strike control bill (H. R. 4908) which passed the House by a 258-155 majority Feb. 7, but only a watered version—if any—is expected to be reported to Senate by that pro-labor committee.

Case bill as it now reads would: create a labor-management mediation board; affect employers of 250 or more, invoking a 30-day waiting period before employes could strike if board assumes jurisdiction; empower board to utilize mediation panels and expedite voluntary arbitration; provide for mutual liability under contracts upon employers and employes; prohibit picket-line violence; ban use of boycotts to support jurisdictional disputes, and prohibit supervisory employes from unionizing under National Labor Relations Act.

The latter point, organization of supervisory employes, for which Oil Workers International Union has been campaigning, figured prominently in hearings as ex-Congressman Harry P. Jeffrey of Dayton, O., counsel for Foremen's League for Education and National Assn. of Foremen, and W. Allen Nelson of Detroit, vice president of Foremen's Assn. of America, adopted opposing views on the matter.

Mr. Jeffrey, who said NAF represented 20,000 foremen and supervisory employes and had 140 member clubs in 90 cities of 32 states, contended that a man or woman became part of management when he or she is promoted from production worker to foreman, and urged enactment of Section 12 of the Case bill —which would exempt foremen from the Wagner Act—to "re-establish balance as between foremen who desire to organize for collective bargaining purposes, and those who do not."

"Such legislation," he said, "will remove the artificial government-backed stimulus which has been given to foremen unionization through the National Labor Relations Board interpretation of the word 'employe' contained in the National Labor Relations Act."

The ex-Ohio Congressman said he believed the intent of Congress at the time Wagner Act was enacted had been violated, and confusion has arisen by reason of the "vacillating and conflicting" decisions of the NLRB.

"The resulting confusion and this bureaucratic enlargement, if no violation of the intent of Congress, makes legislation defining supervisory employes imperative," he asserted.

Mr. Jeffrey maintained that the foreman must remain an individual responsible only to his employer, pointing out that his ability to represent his employer is forfeited if his allegiance and loyalty are divided—as must be done if he also belongs to a union which includes production workers as well.

The National Assn. of Foremen, he said, was an association for mutual self-help through education, literature, and association; it did not represent its members for collective bargaining purposes, believing each individual's interests would be served best by individual bargaining.

Foreman's League, with 1200 members, was organized only eight months ago for the specific purpose of assisting organizations such as the NAF, Mr. Jeffrey testified.

Cites Foremen's Assn. Aims

On the other side of the question was Mr. Nelson, who said the Foremen's Assn. of America was organized with the very definite purpose of representing its members in collective bargaining activities and in all of the relationships between the employe-members and their employers.

It was organized, he said, with the conscious knowledge that there was need for representation of foremen in their dealings with their employers, and now boasts a membership of 30,000, with 230-odd chapters representing 200 separate employers.

Mr. Nelson said the modern foreman was a technician, as specialized a group of employes as toolmakers or laboratory technicians, but never could be anything except an employe in his fundamental relation with his employer.

"There is nothing at all incompatible with the foreman representing his employer in the relations between the rank and file worker under his supervision, and his company," he asserted.

"I have been informed by many foremen that they have been enabled to interpret the contract (the company's contract with a union representing the plant's production workers) and do a better job, and have been commended by their employers, as the result of their association together in an organized capacity," he added.

The Case bill as it now stands, Mr. Nelson said, not only would deprive foremen of the right to collective bargaining but actually deprive them of the right to organize. He said the foremen knew the results of the removal entirely of the protection of Section 7 of the Wagner Act, having had plenty of it visited on individual foremen who became members of the association.

"The Case bill as a whole, of course," Mr. Nelson said, "tends to destroy the effectiveness of the gains of labor over the period of 50 years. That is the general reaction we get from the reading of the Case bill in general, and therefore is negative legislation that cannot perform the service that is indicated by the title, that it is hoped from the bill."

"It will stir up trouble, stir up differences, and—frankly, I am wholeheartedly in accord with the effort to bring about a composition, or a quieting, of the friction that exists between management and labor, but this bill will not do it," Mr. Nelson concluded.

Only organization which has come out in favor of the bill as now written is the National Grange, although many groups and many Congressmen favor some sort of labor legislation. The Case bill was passed in the House by a coalition of Republicans and southern Democrats.

Present Provisions of Case Antistrike Bill

WASHINGTON — The Case bill, as it now stands, does these things:

1. Creates Labor - Management Mediation Board, appointed by the President and containing equal representation for labor management and some public members, which would have jurisdiction over any labor dispute which "substantially obstructs or interferes with interstate or foreign commerce and affects the public interest and cannot be expeditiously adjusted by collective bargaining."

2. Requires employers of 250 or more employes, and employes in those plants to give the board five days written notice before conducting a strike or lockout, and to refrain from the lockout or strike for 30 days if the board assumes jurisdiction.

3. Empowers the board to utilize mediation panels, and to try to induce the parties to submit voluntarily to arbitration, where the award of the arbitrator would be binding.

4. Provides for mutual liability under contracts upon employers and employees by allowing suit for damages against either party in a state court or federal district court.

5. Prohibits picket-line violence and forcible attempts to make others work or quit work, with any employee who violated this provision losing his status as an employee under the Wagner Act.

6. Provides that employes who engage in violence, intimidation, or unlawful seizure of property in connection with labor dispute or with a union's organizational activities will lose their rights to reinstatement or back pay under Wagner Act.

7. Prohibits supervisory employees from unionizing under National Labor Relations Act.

8. Bans use of boycotts to support jurisdictional disputes under penalty of losing status under Wagner Act, and provides that any district court having jurisdiction of the parties might award a restraining order or permanent injunction restraining boycotts if irreparable injury would otherwise occur due to perishable nature of articles.

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Independent Oil Men See Case Bill as 'Step Forward'; Jobbers Urged to Wire Senators

NPN News Bureau

CLEVELAND — Organized opposition to antistrike legislation appears to be headed for troubled waters.

Petroleum marketers and jobbers, through their various associations, are beginning to take on some semblance to an organized effort to support the pending Case antistrike legislation in Congress. While some associations have come out in favor of the bill, practically all association officials are urging their members to communicate with their senators in Washington, telling them of their desire to see the measure become law.

The movement appears to be growing and the small business man, at least insofar as independent marketers and jobbers are concerned, is making himself heard. An indication of the tone of voice of this small business man can be found in the following views expressed on the Case bill.

Clyde G. Morrill, executive secretary, Atlantic Coast Oil Conference—The acceptance of the idea that labor shall enjoy equal rights in respect to collective bargaining procedure implies the acceptance of corresponding responsibilities. The right to strike that demonstrates the liberty of the individual worker when controversy arises with management becomes license when brute force controls union votes and makes a turmoil of picketing. There is as much danger in swollen labor funds applied politically as there ever was in huge political donations from large corporations.

Monopolistic practices and uneconomic cartels are very properly prevented by law for the good of all our citizens. It is just as necessary that large labor combines be required to respect the public interest through controlling legislation.

Neither labor nor management should be allowed to become minority millstones that, through better organization, grind the great unorganized majority of our citizens between the two. Protection against management is part of our law. It is time that corresponding protection be legislated against powerful labor interests.

One stone is still grinding. The Senate will act only if we, as citizens, demand such action. Organized opposition to the Case bill must be met with organized demands for protection from thousands of small business men. Wire your senator or quit common scolding against labor.

Robert A. Warfel, secretary, Ohio Petroleum Marketers Assn., Inc.—Strikes, indirectly if not directly, have imposed severe hardships upon petroleum marketers as reflected in serious shortage of badly needed equipment and merchandise. The Case antistrike measure now before the national Senate should have the careful consideration of marketers and they are urged to wire their views immediately to their United States senators as to whether such legislation as already passed by the House should be enacted.

Indiana Independent Petroleum Assn. —Association has wired Indiana senators urging them to support Case antistrike bill. All jobbers being urged to do likewise.

Joseph Hadley, executive secretary, Michigan Petroleum Assn. — Case bill marks the first forward step whereby unions shall be held responsible under their new contracts with employers. With the trend of union activities pointing more and more to the small oil men and to small business generally, Case bill becomes the vehicle through which some protection can be afforded the employer. Oil men everywhere are urged to immediately contact their respective senators in support of this measure.

Denny Klepper, president, Kansas Oil Men's Assn. — Passage of Case antistrike bill will be great step forward in assuring the immediate and future prosperity of America. To survive, America must go to work. I urge all petroleum marketers to contact their senators and ask for the passage of this legislation.

Helen Dorman, secretary, Florida Petroleum Marketers Assn. — Personally I strongly urge all oil men to wire their senators supporting antistrike bill.

Wisconsin Petroleum Assn. — Case bill now being heard before Senate committee deserves full support of all independent petroleum jobbers. Antistrike legislation is badly needed and bill should be recommended for passage without amendments. All jobbers should immediately wire their senators urging Senate pass bill as originally written and passed by House.

Alfred Levine, general counsel, Tennessee Oil Men's Assn. — By direction of President John Fenner Cummins of Tennessee Oil Men's Assn., composed of the independent jobbers of the state of Tennessee, I am authorized to issue a statement to the extent that the Case antistrike bill now pending in the U. S. Senate is constructive measure embodying provisions that are definitely of the most extreme importance to the petroleum products industry. All oil men are urged to promptly wire their senators, assuring them of their approval of this pending legislation and urging their support, and commending the purpose of this legislation so necessary to the peace, harmony and constructive industrial advancement of our nation.

W. A. Parker, executive secretary, North Carolina Oil Jobbers Assn. — Haven't had time to poll our entire membership but those to whom we have talked are strongly in favor of any bill that will put an end to one-sided agreements and will force labor to abide by contracts properly signed by their duly appointed or recognized representatives. We are appraising our membership of the bill and asking them to communicate with their senators direct.

Strikes, Material Shortage Hamper 'Gas' Pump Output

NPN News Bureau

NEW YORK—The immediate reconversion outlook for the gasoline pump industry is not too rosy.

G. Denny Moore, managing director of Gasoline Pump Manufacturers Assn., this week painted this picture:

The war has played no favorites among the totally converted industries. We are all in the same boat. The troubles of the pump makers followed the general pattern. They came out of the war with high hopes and low inventories. They had no finished pumps on hand and not enough of all materials to start up production. Even with the lifting of manufacturing restrictions late in the war and the subsequent allocation of steel for a limited number of pumps, the suppliers of materials could not deliver for months, and then only in dribbling lots.

The same difficulties were encountered with accessories and component parts. Of these items secured from other sources, motors and gray iron castings were most critical. At no time have they been available in sufficient quantities to the entire industry to permit full capacity production.

Compare the present situation with that of any year from 1937 to 1941. In that high production period, it was customary for the industry to carry in stock enough materials and parts to make 30,000 pumps or more. This served as a comfortable backlog in production and enabled the manufacturers to buy materials when prices were most advantageous.

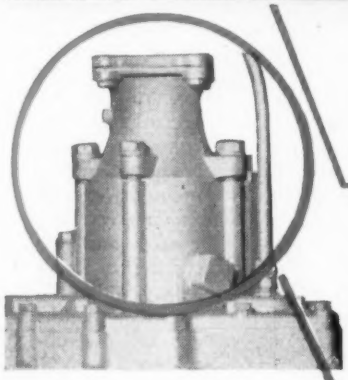
Economical manufacturing of gasoline pumps requires a large quantity of materials in process and this calls for a heavy supply in the plant with a steady flow to every operation in production.

Coming back to the matter of having no pumps in stock when reconversion started. With pump orders pouring in, this was a heavy handicap to the manufacturer and a source of delay for the customer. Having to fill orders hot off the assembly line is not a part of modern practical production. Before the war the industry carried from 25,000 to 35,000 pumps in stock throughout the year, enough to supply the market for three months on the average. This cushion against any stoppage in production or against any heavy orders from stock was a vital factor of protection for both the manufacturers and the market.

Nor did the petroleum marketers escape the drought of inventories. Ordinarily stocking about 30,0000 crated pumps in their warehouses in addition to unfilled orders with the manufacturers, the marketers resumed their peacetime programs with exhausted inventories and have had to rely upon direct deliveries of pumps from the manufacturers for current needs when available.

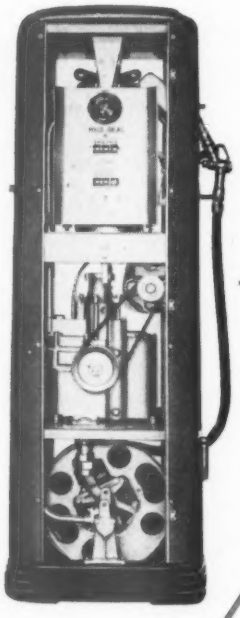
The general walkout in the steel industry, the greatest of all strikes during

THERE'S MORE THAN MEETS THE EYE!



● True the Red Seal pump has a fine porcelain-like finish. *But there's more than meets the eye!*

The steel panels are first degreased and freed from scale and rust. Then each panel is Bonderized—immersed in a special solution that permits the prime coat of enamel actually to "sink in" before baking. It becomes securely anchored to the metal. After this, the finish enamel, likewise baked on, provides the attractive porcelain-like exterior that is there to stay.



At the heart of the pump is the Red Seal Meter—the same type of meter that is giving faithful service on thousands of tank trucks and loading racks throughout the country. It uses a long-approved principle of positive displacement measuring, has only one moving part in the measuring chamber—the piston. No intricate valves to get out of order, no piston rings or leathers to replace. Here is simplicity that makes for accuracy.

Precision engineering is backed by careful quality control of materials, strict supervision of every step in production, meticulous testing of all mechanisms before they leave the factory. The result is a pump you can bank on for a long life of trouble-free operation.

And behind all this is Neptune's Single Unit Replacement Plan. Give any piece of machinery a long enough "stretch" at hard labor, and it must wear or need attention. The Neptune replacement plan permits you to trade in Compact Unit, motor, register, or hose reel at *low cost*—eliminates expensive servicing and repairing in the field. No wonder owners consider the Red Seal most economical!

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A-176

or since the war, had an immediate and far reaching effect upon pump production. The backlog of materials, motors, castings and parts held by the pump manufacturers when the strike began were at their lowest level since the outbreak of the war. Even with the limited production schedule at which the industry was running, there was only enough to last 30 to 60 days. The hand-to-mouth situation which had prevailed since manufacturing began had made it impossible to build up reserve stocks of either pumps or materials.

Now that the strike is settled and steel production has been resumed, the problem seems to be solved, at least, for the present. But the damage has already been done to pump production. Deliveries of steel cannot be made immediately all along the line of manufacturing consumption, and six to eight weeks may have elapsed before the flow of materials will be back to where it was when the strike began. Reconversion for this industry has had to begin over again. This will reflect directly upon the output of gasoline pumps.

In January approximately 6,000 pumps were produced—60% of the prewar monthly output. The expectation, barring strikes, was to return to normal production by May, and thereafter, upward as conditions generally might permit. The steel strike has blighted this hopeful outlook and it may be well along toward the middle of the year before the petroleum marketers will be getting gasoline pumps at the rate they are so sorely needed.

Now for the $64.00 question: "What is the shape of pumps to come?"

Economy in both materials and time can surely be best served under the present conditions of so great a scarcity of both these valuable commodities by going along with the quite modern pumps of 1941. I believe the industry can ill afford the materials or the time to remodel now when the demand for "just pumps" is far greater than the ability to produce and may continue so through the year. Indeed it is questionable if the pump industry could improve for a long time to come the very beautiful and very efficient product now rolling off the assembly lines.

Some Changes May Be Needed

Yes, there are rumors that pumps will be lower and wider, with new built-in features and novelty effects. There is no reason to believe that some such changes will not be made as an addition to the regular line. It has been done before. In fact, there are still in production certain models of special design and with special accessory features. But they are tailor-made products, built to specification and have little if any bearing on what the popular vogue shall be. It is quite likely, however, that when an industry-wide change is made in the gasoline pump, it will consist principally of reducing the height possibly 12 to 16 inches. Even this modification will likely be confined for some time to the super service station field where station design may encourage lower pumps to harmonize with the architecture. With respect to built-in special features for the pump of the future, the wide range in character of service stations throughout the country will offer a limited market for the necessarily more expensive all-service pump.

Just now the manufacturers are having difficulty in getting materials for current models. The petroleum marketers are in desperate need for more pumps than they can hope to get in the next six months, or possibly a year.

With the sidelights of strike threats, price controls, and increasing bottlenecks in materials, the road ahead for the pump industry has problems enough without voluntarily taking on any more. When the crisis has passed and the market makes known its desire for a changed product, the industry will build it. But now, and in the critical months ahead, let us concentrate on the obstacles of reconversion.

1946 Tire Production Seen Hinged on Textile Supply

NPN News Bureau

NEW YORK—Barring interruptions resulting from textile shortages, indications are that tire manufacturers will attain their 1946 goal of 66 million passenger car tires.

A. L. Viles, Rubber Manufacturers Assn. president, made this prediction in revealing that during 1945 the industry produced approximately one tire for every automobile on the road. Production of passenger car casings totaled 28,147,538. While exceeding the war-restricted quotas established early last year, the output fell far short of meeting long pent-up civilian demand.

Mr. Viles said, however, that rapidly accelerating production in the closing months of '45 and steadily increasing production since the first of the year had carried current weekly output to an all-time record high by mid-February.

Textiles continue to be listed as critically short and now it appears production hinges on that item. Mr. Viles stated, however, that by early 1947 the accumulated backlog of tire demand should be nearly satisfied.

The RMA report shows that 1945 shipments of passenger car tires ran only slightly behind production. Shipments totaling 26,804,197 units represented 95.2% of production in '45, although shipments last year were only 49.1% of the 54,560,384 units shipped in 1941, last year of peacetime production.

Exports in 1945 aggregated 212,518 passenger car tires as compared with 586,423 units in 1941. Manufacturers' inventories at the year's end totaled 2,151,539 units as against 3,165,132 in '41.

With the armed services taking millions of casings, 1945 truck and bus tire production far outstripped the '41 output. The estimate showed 16,346,411 units last year; 11,148,278 in 1941.

As in the case of passenger tires, chief uncertainty in the truck and bus tire production picture is the textile shortage.

The detailed report of RMA follows:

Estimated Automotive Pneumatic Casing & Tube Shipments
Production & Inventory—December 1945—Years 1945 & 1941

	Original Equipment	Replacement War Orders	Replacement Civilian	Export	Total Shipments	Production During Month	Inventory End of Month
Passenger Casings							
December 1945	229,497	1,015	3,183,431	28,834	3,442,777	3,791,605	.....
November 1945	341,536	1,466	3,113,702	24,864	3,481,568	3,683,522	1,837,516
Year 1945	1,116,158	124,798	25,350,723	212,518	26,804,197	28,147,538	2,151,539
Year 1941	19,855,693	.....	34,118,268	586,423	54,560,384	50,391,918	3,165,132
Truck & Bus Casings							
December 1945	148,490	6,946	662,143	36,564	854,143	1,026,252	.....
November 1945	294,396	6,579	666,856	33,050	1,000,881	989,695	677,014
Year 1945	4,866,521	4,596,380	6,441,150	285,691	16,189,742	16,346,411	851,106
Year 1941	4,924,615	.....	5,776,145	902,790	11,603,550	11,148,278	1,270,933
Total Casings							
December 1945	377,987	7,961	3,845,574	65,398	4,296,920	4,817,857	.....
November 1945	635,932	8,045	3,780,558	57,914	4,482,449	4,673,217	2,514,530
Year 1945	5,982,679	4,721,178	31,791,873	498,209	42,993,939	44,493,949	3,002,645
Year 1941	24,780,308	.....	39,894,413	1,489,213	66,163,934	61,540,196	4,436,065
Passenger Truck & Bus Tubes							
December 1945	390,450	20,960	3,168,097	56,195	3,635,702	3,958,851	.....
November 1945	667,279	10,609	3,297,643	47,068	4,022,599	4,245,000	3,387,251
Year 1945	6,118,575	4,632,855	28,528,249	408,179	39,687,858	41,101,866	3,670,544
Year 1941	24,721,558	.....	33,749,308	1,232,097	59,702,963	57,432,767	4,685,904

...nel ... temporary headquarters went to Lake Success and the permanent capital to the World Fair site.

...somewhat like ... elongated Pentagon Building in Washington which houses more than 30,000 employees," probably would seriously affect vitally needed home ... library, auditorium, music room, gymnasium, door swimming pool. One complete wing will be devoted to hospital facilities.

...obviously ... acknowledged that the separat... were operating in Khamseh, armed with weapons which were distributed by unknown people.

...business, particularly the Lehigh service a... first trip Sam coll... passenger "You Sam. "Wh... "They're they?" "Anni... He w... and let "Anni... He w... ward a... body at "Gu... today," edly. Jersey's took c... across The water ... Commu... in the Jersey ... been fo... this 30... 30 year... barges, rain an... cold. N... quit.

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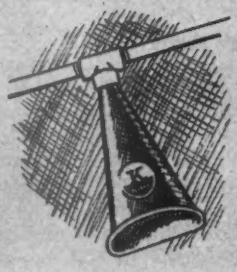
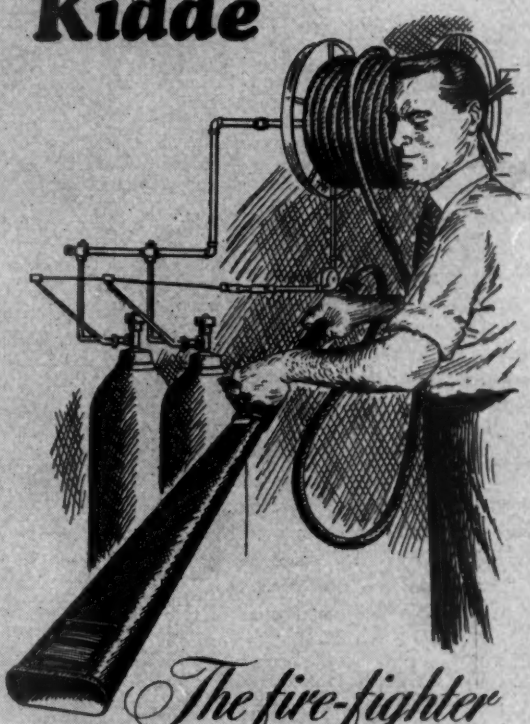


PUTS FIRE OUT IN TWENTY SECONDS!

Shielded nozzles supplied with Kidde Total Flooding Systems rapidly fill threatened space—floor to ceiling—with carbon dioxide. Fire is smothered in seconds.

Kidde



The fire-fighter with a 50-foot swing

Kiddie Hose Reels pack a real-fire-killing wallop. Hose length up to 150 feet gives operator plenty of freedom for action in extinguishing flames. New light-weight reel. Supplied with one or more 50-pound cylinders of carbon dioxide.

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GI Students Ask VA

General output at factories and mines decreased 4 per cent in October, while in the first half of Novemb... sic in... leum

Home from Manila,

stationed in a little town in France for several months, wooed a French girl by telling her about ... into

Oil Industry Tackles Reconversion Of Dirty Service Stations

There is plenty of evidence behind the scenes that major oil marketers are doing something about lax and dirty service stations. The oil industry, unlike so many others, suffers no shortage of products to sell. Instead there is an oversupply. There is also an oversupply of men who want to sell gasoline. And while there are 20% fewer marketing outlets, there are enough to handle the coming spurt in volume. All they need is rejuvenation.

What marketing executives of major oil companies think about it, what plans they have started, or will start soon is told in this article, the fifth in NPN's series on Station Service for Profit.

By Frank C. Sturtevant
NPN Staff Writer

Spring housecleaning at major oil company service stations involves more than just eliminating of the dirt. The real problem is to clean up the state of mind that has accepted constantly dirtier surroundings, along with slack service, as a necessary evil.

It's a hangover from the war of course, and has rooted itself not only in the service station operators, but in some oil company salesmen and supervisors as well. Perhaps not fully aware of just how far from clean their stations really are, more than one company is tackling the problem by giving it a subordinate place in the general sales programs. As this will be the first year high quality petroleum products are all in good supply, many sales managers will promote the products and their postwar merits first. However, the sales advantages of courtesy and clean stations will not be forgotten, and in some cases may even get special treatment.

Drastic reform measures could be set in motion if more management people found time for a random inspection of a few stations in person. While most are willing to admit the average dealer or station lessee has probably slipped a little from prewar minimum standards, the full extent of this lapse from good selling practice truly has to be seen to be appreciated. Up to now it has been just one of the many problems left over from the war, all demanding attention from staffs not yet fully organized for peace. Also, perhaps in the surroundings of modern offices and clean desks, the problem seems a little remote, and more the fault of an already over-burdened maintenance department.

Maintenance in the form of new paint can help, especially for the oil company sales force. They have been plagued for a long time with more pressing problems, until they have acquired the same blind spot for dirt that today afflicts the great majority of station operators. This is tacitly admitted by some oil companies which are not relying on their regular men for any effective cleaning up. Instead they are assigning special men to the job of inspecting and reporting. In this way they hope to get clean-up work into a class by itself, free from the deadly thinking born of a wartime atmosphere of apologies and excuses.

The regular force of salesmen and supervisors spent the war trying somehow to keep the stations open. In keeping their remaining dealers and operators satisfied, they naturally lent a sympathetic ear to complaints, not only about equipment shortages, but also of lack of help, rationing, black markets and all the other burdens dealers laid on their shoulders. It is not surprising that after three years of this, and of not looking too closely at the accumulating dirt, many of these men just do not see it any more.

Then too at the end of the war, the first problem seemed to be the matter of lengthening station hours of business. This still claims the major attention of salesmen, because progress in that direction has been slow and stubborn.

Adding to the difficulties is a feeling on the part of some executives that those dealers and lessee station operators who are satisfied to spend their working lives amid dirty surroundings, are not going to be reconverted in a hurry, and some perhaps not at all.

This defeatist attitude, though probably common throughout all business circles because of similar causes, is foreign to American ways of thinking. It should recede swiftly once a new start is made. Even lukewarm efforts, whether undertaken as part of sales program, or just arising out of an inborn American aversion to dirt, have a way of generating enthusiasm as they go.

And not all of the efforts are going to be lukewarm, by any means. One oil company executive is reminding his staff that a thorough station clean-up will, by itself and without any other effort, bring an immediate increase in gallonage. And at least one or two companies are certain to break out with advertising in which efficiency, courtesy and clean restrooms are mentioned as part of the service they are prepared to offer postwar motorists. Thus competition will drive everyone to undertake some improve-

Calls Attention to Bean Service Station Article

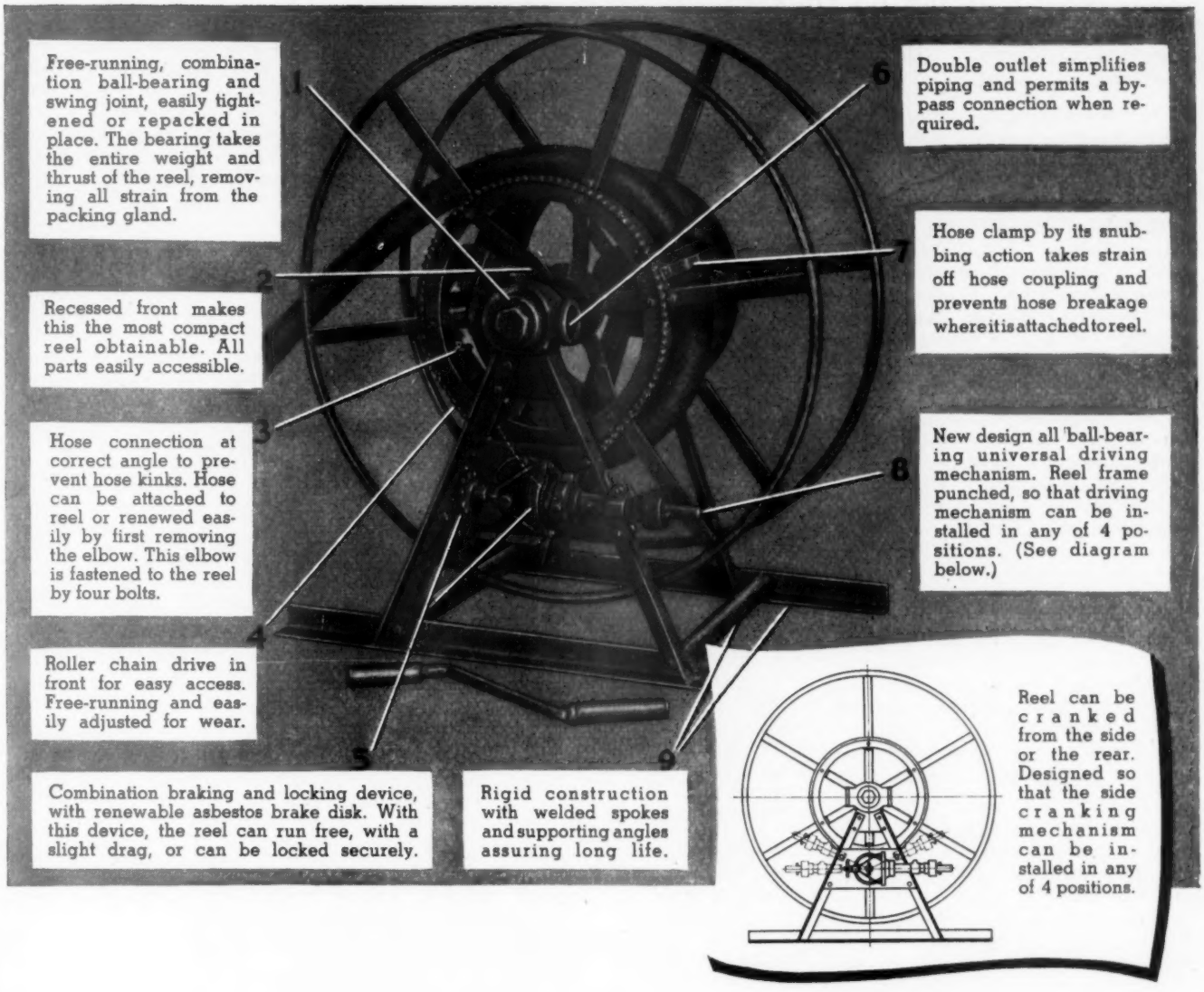
NPN News Bureau

CLEVELAND — F. A. Bean's report on service stations of today in Feb. 6 NPN will receive considerable attention in North Carolina if a suggestion carried in Feb. 19 North Carolina Oil Jobbers Assn. Bulletin is followed by its readers.

Says the Bulletin in part:

"If you are not already a subscriber to National Petroleum News, borrow, beg or steal the Feb. 6 issue from some subscriber and read the article on p.26 about the service stations of today and tomorrow. Also get the Feb. 13 issue and read the follow-up article on p.32 relative to cleanliness, sales appeal and trained operators. . . . We believe these articles might prove to be an eye opener, not only to beginners, but to old timers as well and since service station operators look to you, as their supplier, for advice and suggestions, you should, by all means, read those articles and be prepared to help them raise their standard of living and public appeal so far as service stations are concerned. . . .

"Another worthwhile article in Feb. 13 issue on p.26 is 'Oil Burner Manufacturers Look to Fuel Oil Jobbers to Play Important Role in Huge Postwar Expansion.'. . . The article in question is very informative, covering not only the handling of fuel oil but of oil burners and the servicing of oil burners. If you have any doubts about the advisability of pushing or even handling fuel oil, be sure to read this article."


1
Free-running, combination ball-bearing and swing joint, easily tightened or repacked in place. The bearing takes the entire weight and thrust of the reel, removing all strain from the packing gland.
2
Recessed front makes this the most compact reel obtainable. All parts easily accessible.
3
Hose connection at correct angle to prevent hose kinks. Hose can be attached to reel or renewed easily by first removing the elbow. This elbow is fastened to the reel by four bolts.
4
Roller chain drive in front for easy access. Free-running and easily adjusted for wear.
5
Combination braking and locking device, with renewable asbestos brake disk. With this device, the reel can run free, with a slight drag, or can be locked securely.
9
Rigid construction with welded spokes and supporting angles assuring long life.
6
Double outlet simplifies piping and permits a by-pass connection when required.
7
Hose clamp by its snubbing action takes strain off hose coupling and prevents hose breakage where it is attached to reel.
8
New design all ball-bearing universal driving mechanism. Reel frame punched, so that driving mechanism can be installed in any of 4 positions. (See diagram below.)
Reel can be cranked from the side or the rear. Designed so that the side cranking mechanism can be installed in any of 4 positions.

The New Hose Reel You Have Been Looking For

COMPACT, RUGGED, LIGHT IN WEIGHT, BALL-BEARING CONSTRUCTION THROUGHOUT

The New Philadelphia Valve Co. reel is the finest reel built. It is compact, rugged, and light in weight. All parts are of steel, malleable iron, or bronze; no cast iron is used. It is ball-bearing throughout with hardened and ground races. (6 ball bearings are used.) It will never wear out.

The reel can be changed from top winding to bottom winding by reversing the hose connection and rotating the drum. All working parts and hose connections are in front and easily accessible. It is light in weight, a reel that holds 100 feet of 1½" hose, weighs only 93 pounds.

We can furnish hose reels in any size or shape. They can be furnished for installation either in bucket box at rear of truck or in underslung box on side of truck. Give inside dimensions of box when writing for information. Special reels can also be furnished for Airfield Refueling Pits and Ship Docks.

Delivery can generally be made in a few days after receipt of order. For sizes, prices, and dimensions, write for Catalogue No. 165.

PHILADELPHIA VALVE COMPANY
ARAMINGO AVENUE AND ONTARIO STREET, PHILADELPHIA 34, PA.

Oil Marketing Equipment Company, 321-325 Fremont Street, San Francisco 5, Cal.

ments in station conditions, and the means employed will be a combination of persuasion and pressure.

Persuasion will form 90% of the drive. Dealers will be told how customers soon will be invited to sample the better service and the cleaner stations run by their competitors, and how loss of business will penalize those who fail to snap out of their old ways. Today motorists are able to drive around more freely and to make occasional visits to other than their favorite service stations. They have the privilege of quietly withdrawing their business if they are better satisfied elsewhere.

All companies have been greatly strengthened in their position by the large number of applicants for dealerships and station leases. While they are telling dealers about the departure of easy days and about the certain return of a more critical attitude on the part of the customers, they are also letting them know how many men are bidding for their stations. They are not keeping secret the fact that people are coming in to their offices asking to lease stations closed or abandoned during the war. While shortages continue elsewhere, the petroleum industry is in the unique position of having both an oversupply of gasoline and an oversupply of men who want to sell it.

Experienced men in management positions are no longer impressed by gallonage done at stations where the personality of the staff rates high, but the housekeeping low. They know the bad housekeeping drives away some additional trade the station could otherwise have. They recognize, too, that the competition which is already here, and growing, must be met with station equipment only a little improved, because of meager replacements. They are through apologizing for industrial delays holding up new equipment and are making polite, but prompt and decisive answers to complaints on this score.

Little Need for Apology

Indeed there is no reason why oil companies should shoulder the blame for something over which they obviously have no control. Instead the industry as a whole, right down to the service station operator himself, can draw favorable attention to the fact every motorist can have all the gasoline his tank can hold. And as for necessary pumps, meters, hose, air compressors, lifts and all the other equipment needed by the modern service station, the oil company maintenance crews have more than done their share in keeping them going.

With maintenance calls running at five times their normal average, the service rendered on the whole needs little apology. Dealers who have found some obscure justification for their own slack housekeeping in this continued patching of old equipment, need to be jarred out of a rut. They are being reminded that the restroom can be put in first class shape by their own efforts, whether the pump out on the island is new or old.

The only thing needed is a little work, not particularly hard or heavy. The former excuse of lack of time cannot apply today when the labor market is overflowing with returned veterans and displaced industrial workers. Every station operator can hire all the help he needs. Actually the plea of being too busy was never more than self-delusion on the part of the station operator. Even in a one-man station time is saved and work lightened, if cleanliness and order are the rule.

Repainting leased stations will be done on a much more generous scale this year, although the speed with which this will be accomplished will vary from one company to another. Some maintenance departments have made it a practice right through the war to keep their own paint crews and trucks working steadily and now are all set with men and supplies. Their stations will get new, fresh coats of paint inside and out, including pump shells, light standards and other equipment. Companies who depend on outside contractors for all painting are trying to speed up their programs. Some have already let contracts, and have part of the work underway.

During the war companies who had set up fixed intervals for periodic repainting could not keep on a regular schedule. They repainted when they could, and many times even a limited repainting program could not be completed between spring and fall. Now however, great efforts are being put forth to get stations painted before the end of spring, thus giving every station the full advantage of exterior eye appeal during the peak season. This will be no easy task as paint contractors have plenty of business and do not have a full quota of skilled men. A repainting program, like an advertising campaign, goes far to impress dealers with the need for an improvement in the kind of service they render and in the need for cleaner conditions inside the stations.

Also like the advertising, its two-way effect—inside the organization, as well as outside—is best realized when its value is thoroughly exploited to the entire dealer organization. As a part of brand publicity, paint, signs and advertising are designed to bring customers into the dealer's station. During the days of restricted driving many a dealer grew into the notion his customers depended on him, and that he needed neither advertising, good service or a clean station to hold his business. His estimate of his own importance in the merchandising chain had some justifiable foundation because service station men did perform a great service in keeping cars operating under difficult conditions.

His customers stayed with him whether his station was clean or dirty and he continued to make good money, so there was

Says Most Stations Are Up to Par in Wisconsin Area

CLEVELAND—W. L. Dunnigan, president, Black Eagle Oil Co., Milwaukee, Wis., sends the following comment on Mr. Bean's article which appeared in NPN, Feb. 6:

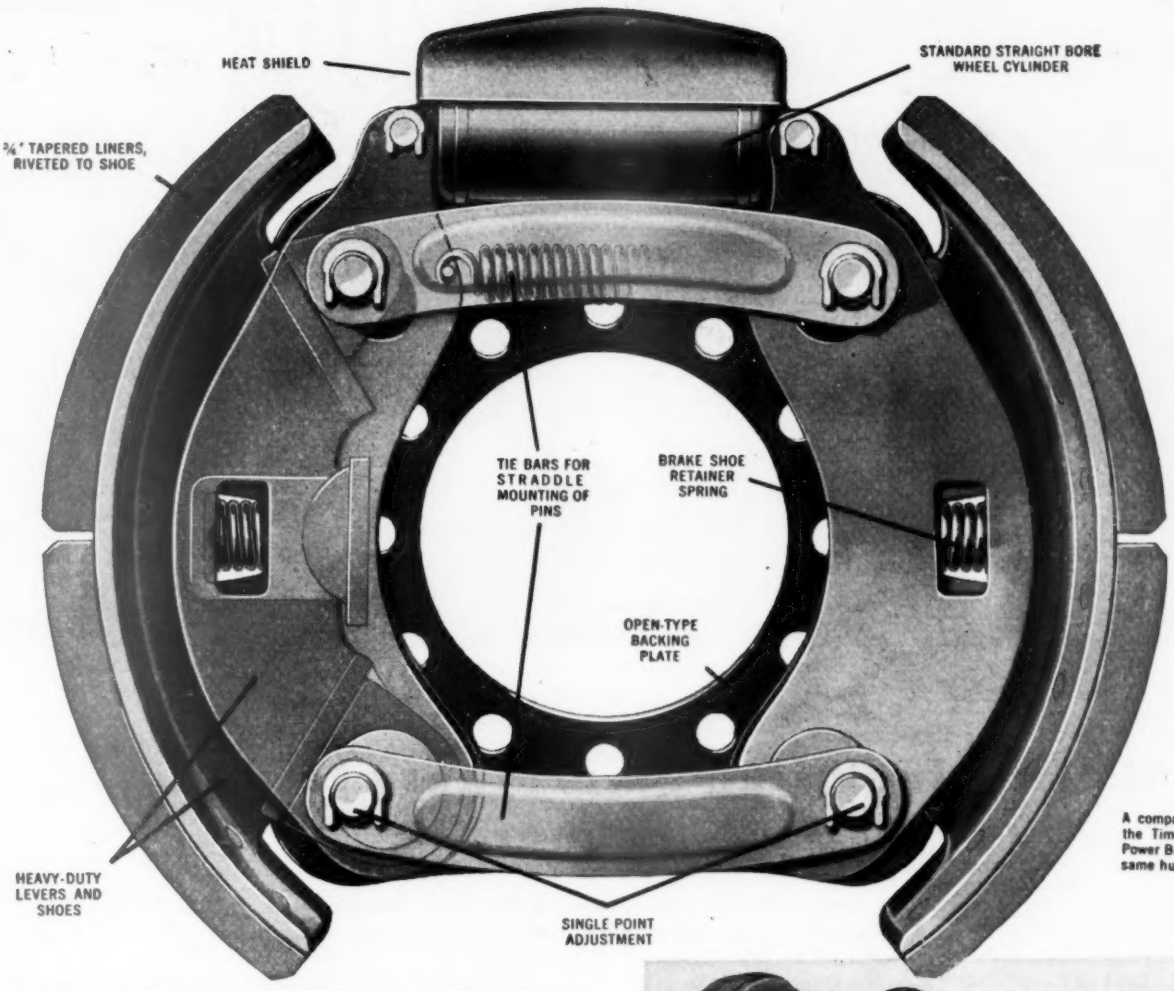
I read, with much interest, the article by Mr. Bean in National Petroleum News. I am sorry however, that Mr. Bean did not get into the northwest corner of the territory he described, because he would have found that the reverse was true.

In spite of the manpower shortage, type of personnel, and war nerves, most of the companies, at least in the territory in which we operate, did a pretty fair job under the most trying conditions, to service the motoring public in such a way that, while not being parallel with prewar service, they did an excellent job. In our own case, the housekeeping of our average station by the lessee is not as good as it was prewar, but that was only because the lessee, as well as ourselves, did not have sufficient manpower to maintain a 100% housekeeping job. Our service too, suffered somewhat, but not to the extent that Mr. Bean described, and perhaps the reason we were more fortunate than some was because all of our lessees have been with us for from 10 to 18 years. We lost only two lessees to the Army and these men had their places so well organized that they kept going pretty much as they would have gone had they been there.

We lost considerable of our other key personnel and, of course, had to replace them with what was available. Don't misunderstand me in regard to the above, that we did not have our troubles, because we did. But through co-operation of the key personnel in our organization, we feel we did a fair middling job for our customers, and I feel that that is true in most oil companies who operate in the western part of Michigan, Wisconsin and Minnesota. Today I think that not only our own but most all stations in the territory mentioned, are back on a prewar basis of giving courteous and efficient service to the motoring public.

I believe I can speak for most independent operations when I state: Give us more items, like Mr. Bean's and like your own survey in Cleveland, and more merchandising and service items. We like NPN and have been a subscriber since 1927.

The only TRUE HEAVY-DUTY Hydraulic Brake*


HEAT SHIELD
STANDARD STRAIGHT BORE WHEEL CYLINDER
¾" TAPERED LINERS, RIVETED TO SHOE
TIE BARS FOR STRADDLE MOUNTING OF PINS
BRAKE SHOE RETAINER SPRING
OPEN-TYPE BACKING PLATE
HEAVY-DUTY LEVERS AND SHOES
SINGLE POINT ADJUSTMENT

A companion brake to the Timken P Series Power Brake—uses the same hubs and drums.

* The New Timken DP Heavy-Duty Hydraulic Brake

The new Timken DP "Dual Primary" Heavy-Duty Brake is the only *true heavy-duty* hydraulic brake made today because:

1. **It has big ¾" tapered liners for even wear and longer life in heavy-duty service.**
2. **It has open-type construction for maximum circulation of cooling air, giving increased braking efficiency with decreased fading.**

It incorporates all the advanced features which have made the Timken DP Hydraulic Brake outstanding in the medium-duty field. For example: *Both shoes are forward-acting* in both forward or reverse. Braking effect is increased as much as 35% at all accepted hydraulic line pressures. There is only *one point of adjustment* per shoe—and it is easily accessible. *Shoes are easily and quickly removable* for relining by simply removing the retainer spring. Hydraulic cylinder and anchor pins remain undisturbed.

Specify this new DP "Dual Primary" Brake for heavy-duty service. Write for free folder today.

The DP Heavy-Duty Hydraulic Brake is optional equipment on the famous Timken S & U Series Heavy-Duty Axles.

The Accepted Standard

TIMKEN AXLES

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WISCONSIN AXLE DIVISION • OSHKOSH, WISCONSIN
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This may look like an ordinary terminal... but it's more!

It's Part of America's Most Complete Warehouse System for Liquids . . . General American Tank Storage Terminals.

General American Terminals provide you all the privacy of your own warehouse... plus years of experience in the specialized handling of any liquid that can flow through a pipeline.* General American's world-recognized reputation for reliability and responsibility is your guarantee of the safety and purity of your product.

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**Here is a partial list of the liquids handled in General American Terminals.*

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Lubricating Oil	Toluol	Animal Oil
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Division of
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a tendency for him to feel he had them sewed up. It takes a merchandising campaign to tell him how he personally stands to gain by cleaning up his own station; returning to old ideas of service and courtesy, and how reform on his part is tied up with repainting and advertising done for him by his supplier.

Will Attract New Customers

Just resting on his oars won't be enough to hold all his old business, but performing his full part in the united selling effort will not only prevent his old customers from drifting, but will attract and hold many a new customer as well. This last is a point which the major oil marketers will be at some pains to demonstrate.

It takes clear explanation to convince a dealer of the stake in what he sometimes thinks is a one-time customer. Stations which are not solely roadside tourist stops, nevertheless have many customers not known to the station operator. To them, the service he gets, including the condition of the station and its restroom and its facilities, goes a long way to establish or destroy brand preference. But at the same time a large percentage of these strangers are possible repeat customers if the service and surroundings are attractive. The company sales managers are fully aware of this, but dealers need to be sold again and again.

Few dealers can ever accurately divide the dollars and cents profit they realize from neighborhood trade, as contrasted with the so-called casual or transient trade. The solid base of neighborhood trade is important, of course, and well worth cultivating. But the greatest automobile mileage is run up by men traveling for various commercial or business purposes, and many of them travel the same routes again and again. They like to stop at stations they remember and like, but may not stop frequently enough to become known to the station operator. As a group they are valuable customers.

So too are the pleasure tourists. They also may travel repeatedly over the same roads and through the same towns. They also come to associate certain brands with clean stations and good service. It is only good business to assume that every customer who rolls onto the driveway will be a repeater. For operators who follow that plan, many of them will be.

Some companies will wrap up these ideas in a general sales package, including all other points of station selling. Some will work on it as a separate project. Every oil company has some kind of a service station manual, but some are being revised and rewritten. One or two companies have manuals or charts bearing on station housekeeping alone. Schools and dealer meetings are being scheduled or are already under way, in which housekeeping, as a part of good station practice, will get some new emphasis. It all adds up to the fact that the spotlight is again on the retail outlet, just as in prewar years.

Eastern States Gasoline Assn. Replies to Bean

NPN News Bureau

CLEVELAND — Among the letters received by NATIONAL PETROLEUM NEWS regarding F. A. Bean's article in the Feb. 6 NPN is one from Harry R. Wainwright of Washington, D. C., member of the Executive Committee of the Eastern States Gasoline Assn.

Mr. Wainwright's letter, which is published in full, should be read with the following facts in mind.

1. Mr. Bean's article was the beginning of a series in NATIONAL PETROLEUM NEWS to give the industry material with which to work in building a new era of Station Service for Profit.

2. Mr. Wainwright compares oil industry service and housekeeping with that of other retail outlets. The important thing is not how bad others are, but how good the oil industry service station should be, as a matter of good merchandising and good public relations. Anything less than the best is not a proper standard for the oil industry.

3. NATIONAL PETROLEUM NEWS recognizes, as does oil management, that wages and other costs are rising, but the answer to this problem is better management and better salesmanship, not resentment of criticism.

4. Mr. Bean has had vast experience in service station construction and operation.

Following is Mr. Wainwright's letter:

At the February meeting of the Executive Committee of the Eastern States Gasoline Assn. I was instructed by the committee to write an answer to F. A. Bean's article on service stations in NATIONAL PETROLEUM NEWS issue of Feb. 6.

I believe that I should say here that it is a habit with John Dressler, president of the Eastern States Gasoline Assn., to notify members of the Executive Committee two weeks in advance of any new subject to be discussed at any of the monthly meetings and Mr. Bean's article was included in this notice for the February meeting. The entire committee, made up of John Dressler, New Jersey; Allan Feinman, New York; Fred Moore, New England, and Harry Wainwright, Southeastern States, was present.

The sun must have been shining very brightly all during Mr. Bean's trip and he was evidently wearing dark glasses and, therefore, could only see black wherever he looked. We agree that all the conditions that Mr. Bean called attention to in his article do exist to some degree. However, we are sure that a man wearing dark glasses could have found some percentage of these same conditions existing five years ago or ten years ago. In our estimation, the proof of Mr. Bean's ability to only see black is the fact that he complains about the driveway of a service station that should never have been built in the first place, and that a driver was sprawled in the doorway of a station, and that he also finds fault with a motorist's car when it happened to have torn fenders.

Possibly the members of the Eastern States Executive Committee when they made their individual inspection tours in their territories were wearing slightly rose tinted glasses because each individual reported that while you could find Mr. Bean's conditions existent if you looked for them that you could find the exact opposite with good service and clean restrooms, etc., if you looked for them.

It is hard to determine from Mr. Bean's article whether or not he has had active experience at the marketing or service station level of our industry, in fact, we are going to guess that Mr. Bean has never actually operated a service station and that his activity was probably at a higher level in the industry; a level that more than likely has very little mortality in comparison with the service station level which has a yearly mortality of at least 20%. No other level of the petroleum industry has as great a mortality as the service stations.

No other business (restaurants, grocery stores, and any or all of a dozen others) can begin to compare with the service station industry on a basis of service rendered. In the majority of cases "what other retail business provides restrooms or wash rooms at all", and in the few instances where they do, do they compare with the modern clean restroom in the average service station? An inspection of any other small retail business will bring about a decisive "no".

The writer made a recent trip from Washington, D. C., to Richmond, Va., for the purpose of testifying against the one-cent gasoline tax increase proposed in the State of Virginia. A point was made to examine the service rendered and the condition of the restrooms in 20 stations. Considering the mental condition of employes and of all business men in the nation today, the restrooms were in excellent condition and the service being rendered on the driveway was a close approach to prewar. Of course, we will have to admit that these 20 were outstanding stations, they were all association members, but isn't it a recognized fact that the best business men in any community are members of their trade association?

It is the unanimous opinion of the Eastern States Executive Committee that a man of Mr. Bean's position would have materially aided the petroleum industry if he had searched for and exposed the reasons in back of this apparent lack of service and cleanliness in the service stations he visited instead of writing an article that covered nothing but complaints. Surely Mr. Bean must know that service station employes' wages, although they are now more than double than before the war, having jumped from $15 to $20 a week to a present of $40 to $50 a week and that take home pay of this present

high service station wage is still not as high as the take home wages of the men who are striking in most all other automotive enterprises. A person does not have to be a psychologist to determine the mental condition of the average service station employe. This double pay and mental condition of the average employe gives the employer his number one headache.

Headache number two: The service station owner sees his cost of living and cost of doing business increasing on all sides with only approximately 80% of his prewar business volume coming across his driveway and his profits frozen at a prewar level. Besides his 100% increase in labor cost, most service station rents are back at prewar figures or higher. Wiping or cleaning rags have increased from one to one and a half cents. Driveway and lubrication room cleaner from four and three-fourths cents per pound to eight cents per pound; cover-alls (when you can get them at all) from $2.55 to $4.95 each; tools up 25%; accessories, tires and batteries have been and are almost non-existent, and it is extremely hard to enthusiastically sell when two-thirds of the time you have no merchandise.

And so, Mr. Bean, it is our opinion that generally among service stations and particularly where you find the condition cited in your article a state of mental confusion exists brought about by the following: Is the already double service station wage going to increase further because of the recent increases granted to union labor? Are rents that are already prewar and higher going to be again increased? Will the increase in steel and union labor and in meat bring about another increase in general business and living costs?

What should the average successful service station operator earn as wages and profits when the average worker in an oil refinery based on a 60-hour week (most service station owners work at least 60 hours a week) makes $5000 a year at present wage scale? The refinery worker has no capital investment or should we say, risks no capital, receives social security benefits, receives workman's compensation and is more than likely a member of a group insurance plan. An average service station operator risks from three to thirty thousand dollars in a business where between 20 and 30% are failures, receives no social security benefits and no workman's compensation, he has to be able to successfully buy and sell merchandise and has to have the know how in order to manage his business and train his employes. He takes over all the bookkeeping, taxes, insurance and a hundred and one other responsibilities that go with operating any business. In comparison with the average petroleum refinery worker and laborer with an income at $5000 a year (60 hours a week) the service station operators and owners are wondering what the income should be of the average service station owner and operator. Is the average refinery worker or laborer's income a good one for service station owners or does the added responsibilities and capital risk necessary in operating a service station make the average successful service station operator worth seven, eight or ten thousand a year.

Added to these many problems is the uncertainty of short-term leases.

The answer to all these problems lies within the entire industry's ability to set up a service station structure that will attract high type, relatively high income service station owners and operators. Good volume of business, fair margins of profit, stability of profit and income and fair longer term leases will combine together to attract high type business men to the industry. The reverse combination which we are all familiar with, cut-throat practices and loss of stability within the retail industry, can only bring about to a greater and greater extent less efficiency at the service station level.

And, therefore, Mr. Bean, the major oil companies, division managers, district managers and assistant and supervisors and trade associations, if you will permit me to say so, cannot within themselves lift overall service station efficiency to the point we all desire. They can, however, aid in establishing a business structure that goes with the operating of a service station that will in itself attract the type of men to this industry who will create the highest degree of efficiency you or I have ever experienced.

YOU CAN GET REPRINTS

of any of the articles

in the series on

STATION SERVICE FOR PROFIT

Each week, beginning with the Bean story of February 6, NPN has carried a feature story on some phase of the problem of putting the "service" back into service stations. All of the stories have drawn immediate and continued favorable comment from the industry.

So far, the series includes:

Feb. 6—"Service Stations of Today—What About Those of Tomorrow?"

Feb. 13—"Service Station Check Reveals Lack of Cleanliness."

Feb. 20—"More Applicants for Stations Can Improve Service."

Feb. 27—"Station Service and Housekeeping Remedies on the Way."

This week—"Oil Industry Tackles Reconversion of Dirty Service Stations."

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100-500	.03½
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Orders should be sent as soon as possible to:

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NATIONAL PETROLEUM NEWS

1213 West 3rd Street

Cleveland 13, Ohio

Florida Petroleum Industries Group Adopts 7-Point Program

Special to NPN

JACKSONVILLE, Fla.—Florida Petroleum Industries Committee has adopted a seven-point program for 1946 and is starting a vigorous campaign to reorganize Petroleum Industries Committees in every county in the state.

The seven-point program follows:

1. Eliminate emergency tax on gasoline.
2. Eliminate municipal gasoline taxes.
3. Adopt anti-diversion constitutional amendment.
4. Oppose additional taxes on the petroleum industry and its customers.
5. Eliminate or reduce local privilege taxes.
6. Detect and eliminate gasoline tax evasion.
7. Repeal of federal gasoline tax.

The Florida PIC, in outlining its reorganization campaign, states that all-out concerted efforts are needed to prevent any more taxes being levied on the industry and its customers, and it is felt that now is the time to start an aggressive campaign to bring the problems faced into clearer focus and sponsor appropriate action.

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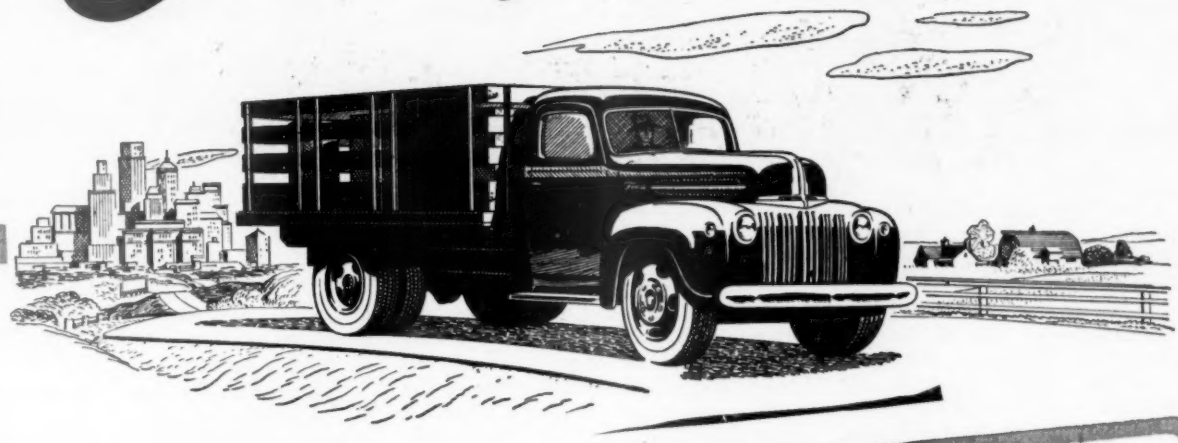

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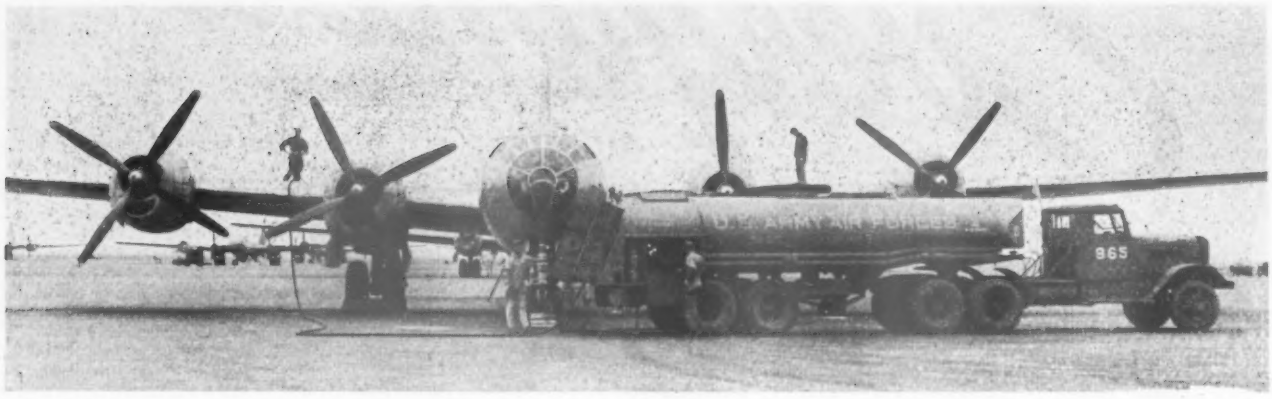
AAF's Aviation Petroleum Branch Kept the Tanks Full of Avgas



—*Official AAF Photo*

NPN News Bureau

WASHINGTON — One of the key organizations in supplying petroleum products to the armed forces during World War II was the Aviation Petroleum Branch of the Army Air Forces, and its operation was mainly in the hands of oil men. The branch had the job of seeing that the AAF got its proper share of 363,922,588 bbls. of grade 100/130 aviation gasoline which was allocated to our armed forces and allies throughout the world during the period from March, 1942, through August, 1945. (See Chart on p. 38 for AAF consumption of avgas against world total).

The story of the Aviation Petroleum Branch begins on July 5, 1941, when Col. Harry W. Howze, a former regular Army officer, was called to active duty from the Standard Oil Co. of N. J. He was commissioned as a reserve, given an office in the headquarters of the Commanding General, Army Air Corps, and told to start planning the world-wide distribution of aviation petroleum products. (Col. Howze has just been relieved and is returning to Jersey Standard). He was joined on April 2, 1942, by Lt. Col. Carl J. Gerken, also of Standard of N. J., who was commissioned and made assistant to Col. Howze.

By February, 1943, a bigger organization was necessary. The Army Air Forces (the name had been changed in the meantime) formed the Aviation Petroleum Branch. Col. David G. Lingle, a regular Army officer, who was well-known to the petroleum industry as AAF member of the Aeronautical Board, was put in charge. Col. Lingle later was transferred to overseas duty and Col. Howze since has been chief of the branch, which is the staff agency of the AAF through which all matters involving petroleum throughout the world have been handled.

The branch was organized after much planning and discussion in conjunction with the other services and government agencies who were concerned with the use of aviation petroleum products.

Late in 1941, many months before the Aviation Petroleum Branch was conceived, it became apparent that a system of priorities must be established to permit availability of limited supplies in accordance with strategic needs. It was determined that all interests could best be represented in the distribution of available production through the medium of a committee operating under the Combined Chiefs of Staff.

Recommended Allocation of Fuel

This group became known as the Aviation Petroleum Products Allocation Committee. It recommended allocations and assignments of all aviation fuels and components thereof to all services. APPAC conducted its operations in accordance with stock levels for all theaters as determined by the Combined Chiefs of Staff.

The need for increased transportation facilities brought about the formation of an agency for the co-ordination of shipping petroleum within the services. In July, 1942, the Army-Navy Petroleum Board was organized. It became the petroleum agency for the Joint Chiefs of Staff.

Representing the Army Air Forces as their representatives to the Joint Chiefs of Staff and Combined Chiefs of Staff on all matters pertaining to aviation petroleum logistics were Col. Howze and Lt. Col. Gerken.

Altogether the combined allocation of grade 100/130 aviation gasoline from March, 1942, through August, 1945, was 363,922,588 bbls., 96.1% of which was shipped to all parts of the world. This work was accomplished so well that no major combat operations were delayed through lack of aviation fuel.

The consumption of aviation gasoline increased constantly and stocks became dangerously low in the European and North African theaters in March and April, 1945. The end of hostilities on May 2, 1945, relieved the critical situation.

To accomplish its mission, the Aviation Petroleum Branch found it necessary to arrive at an estimate on future aviation fuel requirements for each theater of operation. In preparing a basis for making the estimates, operational and other data were obtained and studied. Some interesting facts concerning fuel consumption were discovered.

It was found that the same model aircraft operating in different theaters varied in gasoline consumption rates. Where targets were close to the base of operations a rapid climb at high speed was required, resulting in more missions

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This statement is typical of thousands made by National users all over the country. They have found that National Cash Registers help them operate their businesses more efficiently.

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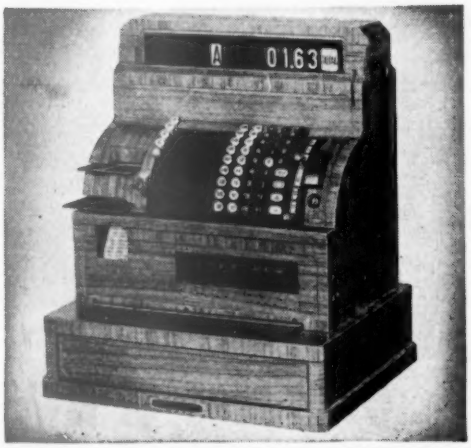
Each, however, provides the basic results expected of a good system . . . control of cash, detailed information on sales, a fast accurate method of handling transactions. Whether your station sells only gas and oil, or offers complete automotive service and a large stock of merchandise, there is a National which will meet your particular needs. Call your local National representative and let him show you how the right National Cash Register system can help you.



One of the National Cash Registers for Service Stations

This National Cash Register is designed for use in service stations. It records sales made in each of five departments and identifies the persons who ring up the sales. It also shows amount of money paid out. In addition, the register prints a receipt on every transaction which shows the date, operator's initial, amount, department or kind of transaction, and the consecutive number of the transaction. A printed history of each transaction is provided on the detailed audit-strip. Ask your National representative for a demonstration. The National Cash Register Company, Dayton 9, Ohio. Offices in principal cities.

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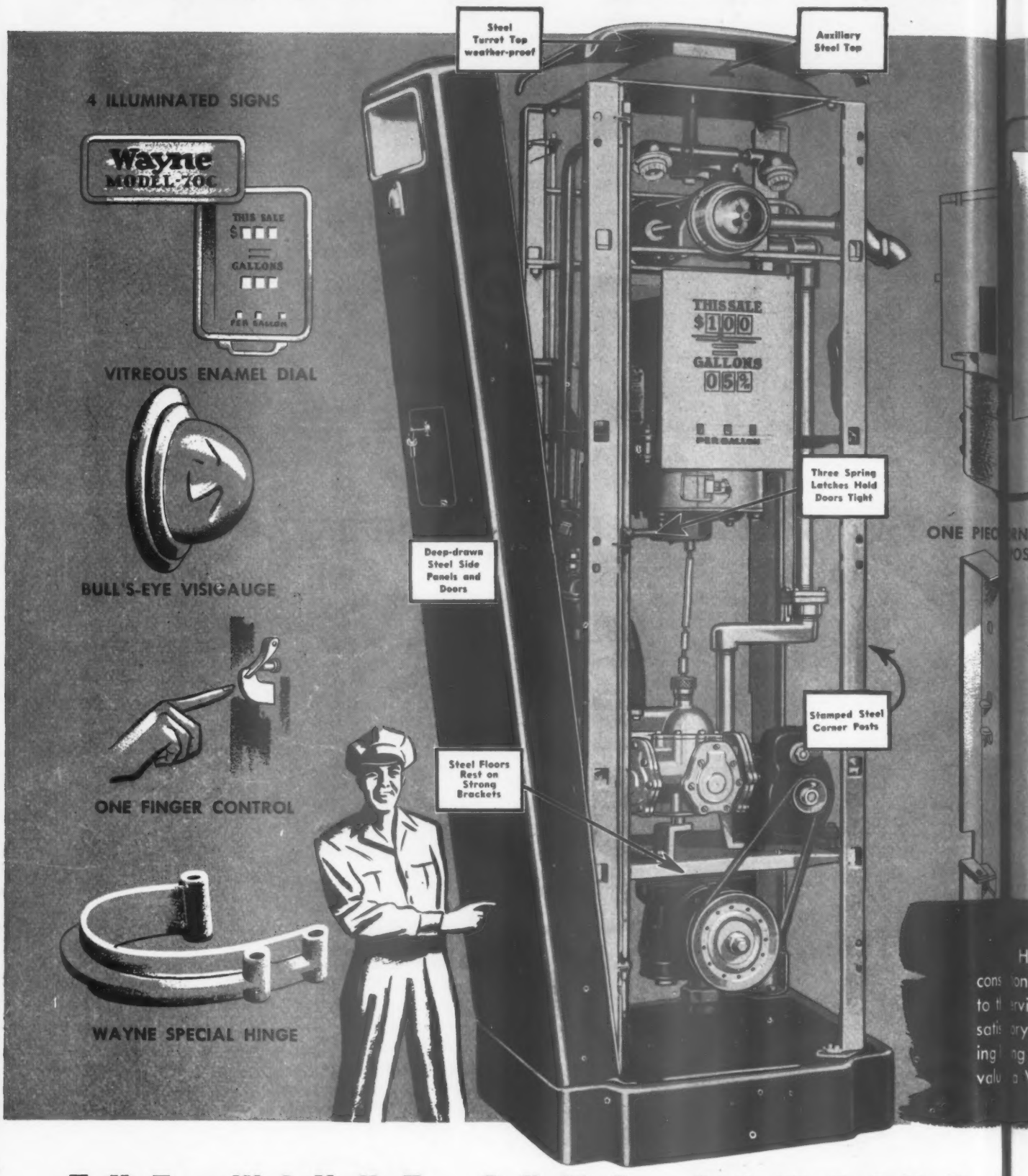

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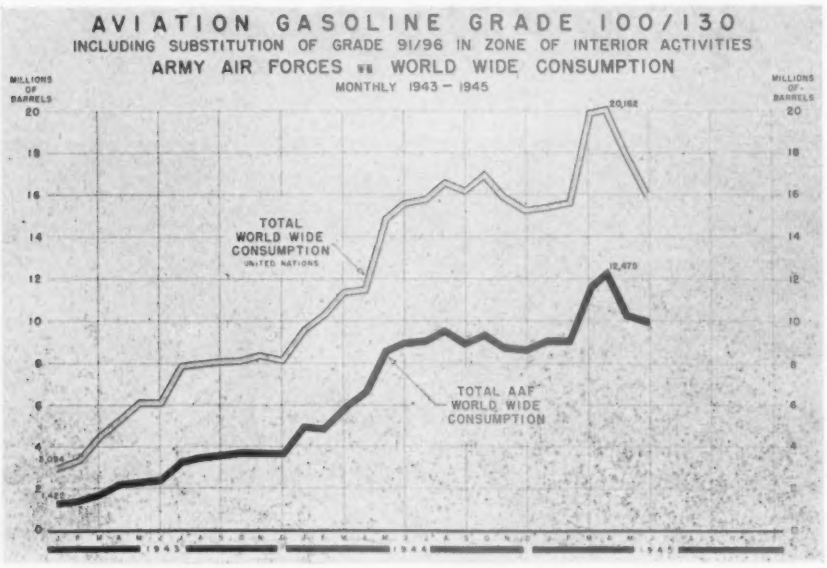


of shorter duration and higher fuel consumption rates. When targets were at great distance a slow climb and slow speed were used, resulting in fewer missions of longer duration and lower consumption rates per hour.

Number of Missions Increased

Lowered attrition rates also altered the amount of gasoline used in a theater. For example, as the Air Force gained control of the skyways in the European theater during the period January-April, 1945, a B-17 made an average of 12.7 missions per month as compared with an average of 7.2 during the first quarter of 1944.

In spite of the constantly changing demand, the estimates became very realistic. For the year 1944, total world-wide estimates for the Army Air Forces only of grade 100/130 was 100,306,000 bbls. compared to actual issues of grade 100/130 and grade 91/96 of 95,848,000 bbls.

When it was organized, the Aviation Petroleum Branch was set up in four sections: The Technical Progress and Liaison Section; the Plans and Requirements Section; the Production and Facilities Section; and the Allocation and Distribution Section.

The Technical Progress and Liaison Section was originally operated by Lt. Col. William B. Plummer of Standard Oil Co. (Ind.) who was succeeded by Lt. Col. H. Claire Dees of Ethyl Gasoline Corp.

One of the section's first jobs was to monitor development and utilization of xylidine as a component of high-quality aviation gasoline. Large-scale processes and production were developed within a short time through the co-operation and efforts of industry, governmental agencies, and the Ordnance Department. Xylidine was used in considerable quantity in high-octane aviation fuel within the U. S. for several months and to some extent in the European theater, thus supplying additional combat fuel during the period of shortage.

A triptane project was assigned also to the section by the War Department, and development work was monitored to test the practicability of the new General Motors process for large-scale production of triptane and provide, through operation of a large pilot plant, adequate supplies of this specialized fuel for engineering studies on high-output engines and high-quality gasolines. The pilot plant was successful in operation and, although the process was not considered practical for large-scale production at the time, it proved valuable for research data.

With the agreement of National Advisory Committee for Aeronautics, the

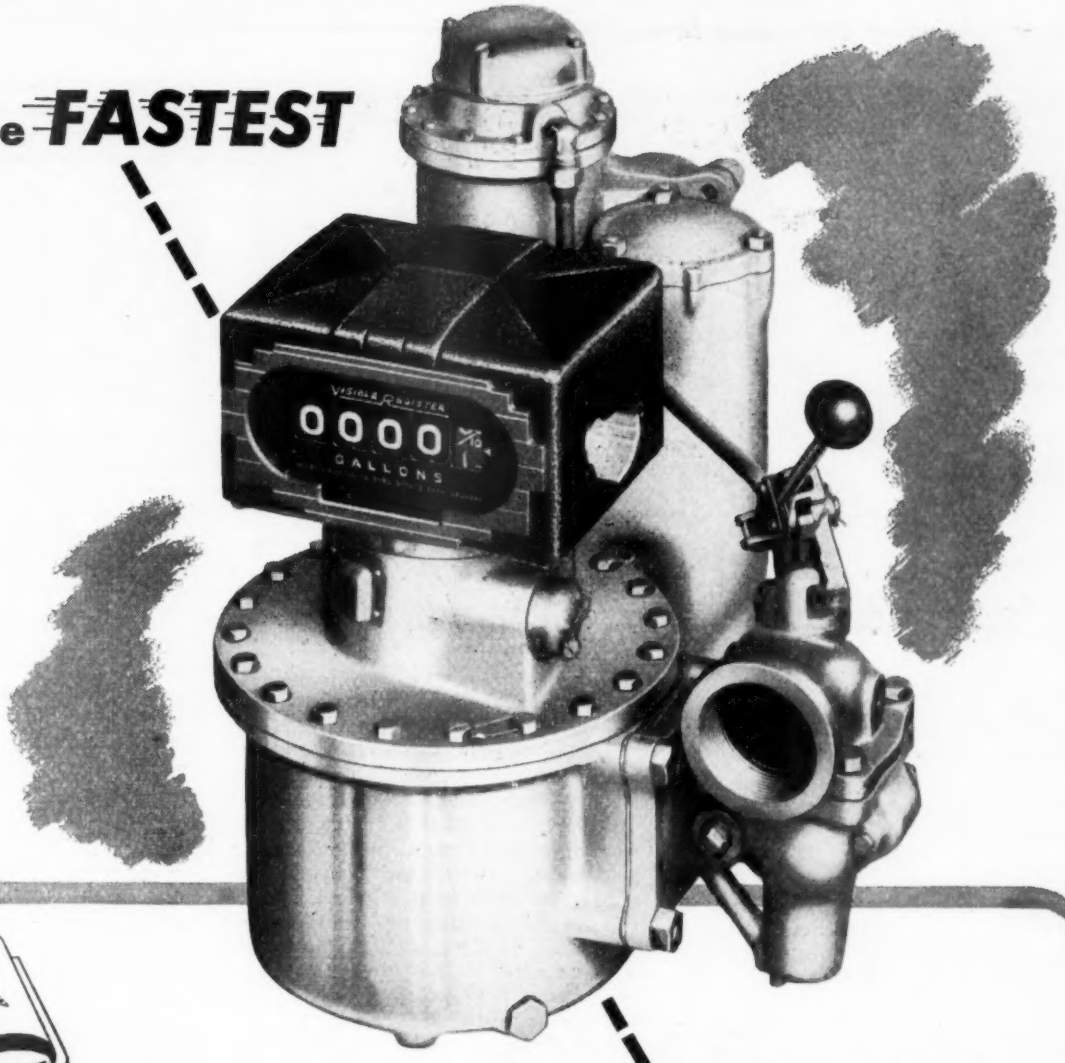
Aviation Gasoline Grade 100/130 Reported Issues by Theaters Yearly 1943—August 1945

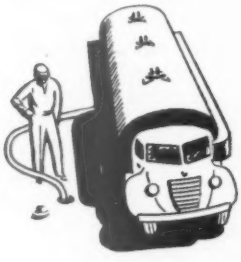
Theater	Jan.-Dec. 1943	Jan.-Dec. 1944	Jan.-Jul. 1945
India China	1,985	8,509	9,993
Ceylon	69	289	242
United Kingdom incl. Iceland	14,236	41,063	24,095
Middle East Group I	3,374	2,413	1,223
Middle East Group II	261	399	315
Middle East Group III	109	96	80
Mediterranean	6,923	16,418	9,832
West Africa and Dakar	697	878	451
South Africa	162	128	127
Caribbean Area	1,537	2,099	1,422
Brazil and Ascension	1,074	1,569	755
Central Pacific	4,653	12,038	13,809
South Pacific	194	202	127
Southwest Pacific	2,839	7,516	7,810
Atlantic Bases	1,159	1,453	998
Alaska	564	961	683
U. S. S. R.	5,912	11,879	5,450
Total Offshore	45,748	107,910	77,412
Domestic Stations—Army	15,580	29,226	27,609
Domestic Stations—Navy	4,680	9,343	7,934
Testing and Flyaway	4,409	5,734	2,869
Canada	1,000	1,073	626
Total North American	25,669	45,376	39,038
Grand Total World Wide	71,417	153,286	116,450

Aviation Gasoline Grade 91/96 Reported Issues by Theaters Yearly 1943—August 1945;

Theater	Jan.-Dec. 1943	Jan.-Dec. 1944	Jan.-Jul. 1945
India China	338	602	62
Ceylon	....	27	16
United Kingdom incl. Iceland	....	10	....
Middle East Group I	456	320	123
Middle East Group II	25	47	31
Middle East Group III	79	32	12
Mediterranean	....	....	....
West Africa and Dakar	82	82	21
South Africa	....	....	....
Caribbean Area	221	358	210
Brazil and Ascension	203	342	170
Central Pacific	21	11	....
South Pacific	....	....	47
Southwest Pacific	993	781	301
Atlantic Bases	19	20	11
Alaska	....	9	17
U. S. S. R.	....	....	....
Total Offshore	2,437	2,641	1,021
Domestic Stations—Army	12,505	21,437	6,453
Domestic Stations—Navy	1,930	3,417	1,988
Testing and Flyaway	4,985	5,155	2,700
Canada	676	481	216
Total North American	20,096	30,490	11,357
Grand Total World Wide	22,533	33,131	12,378

always the **FASTEST**





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The T-10, with 2 inch outlet, is recommended for medium-sized trucks. The T-15, with either 2½ or 3 inch outlet, is delivering gasoline on many installations *by gravity* at flows as high as 145 gal/mi. Easy to install. Available with wide choice of counters, dials, printers and accessories. For complete information, call nearest Smith Meter Co. representative.

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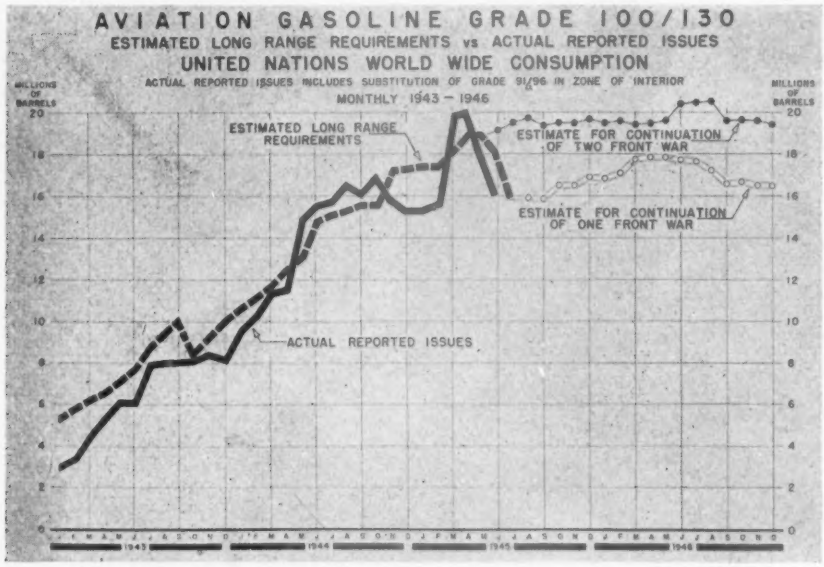

AVIATION GASOLINE GRADE 100/130
ESTIMATED LONG RANGE REQUIREMENTS vs ACTUAL REPORTED ISSUES
UNITED NATIONS WORLD WIDE CONSUMPTION
ACTUAL REPORTED ISSUES INCLUDES SUBSTITUTION OF GRADE 91/96 IN ZONE OF INTERIOR
MONTHLY 1943 – 1946
MILLIONS OF BARRELS
ESTIMATED LONG RANGE REQUIREMENTS
ESTIMATE FOR CONTINUATION OF TWO FRONT WAR
ESTIMATE FOR CONTINUATION OF ONE FRONT WAR
ACTUAL REPORTED ISSUES
1943
1944
1945
1946

section initiated action on a broad evaluation program of high-quality components in aviation fuel.

As the war emphasized the necessity for accurate determination of fuel performance in actual flight in addition to laboratory test practices, the section encouraged flight-test programs by the Army Air Forces. Billy Parker, long experienced airman and fuel engineer, took leave from Phillips Petroleum Co., and joined the section as adviser on the program.

When the Allies reached German soil, the section directed intelligence work for the Army Air Forces in securing information about German fuels and lubricants. It also encouraged dissemination of this information to all U. S. organizations engaged in aviation gasoline production.

In the final work of this section, initial postwar studies were prepared pertaining to future quality of aviation fuels, release of technical information to the press and foreign nationals, and distribution of aviation fuel personnel in an Air Attache's program.

The Plans and Requirements Section was originally staffed by Col. Axel E. Johnson, a private consultant, who was succeeded by Lt. Col. James A. Dawson, an engineer employed by New York City, as chief of the section. E. A. VanName, an industrial engineer, borrowed from the Federal Reserve Bank of New York, was civilian chief of this section.

Prior to the organization of this section, estimates on aviation petroleum requirements were not standardized and the systems used were not accurate and invariably failed to approximate the actual consumption.

This section devised a method for computing gasoline requirements based on the total gasoline required to operate aircraft in accordance with the Army Air Forces planned air strength, known as the Tactical Group Plan.

These computations were based on records of actual operations applied to planned future operations. Operational experience was made available through monthly reports from all activities. Data included operational and nonoperational flying hours by types of aircraft, sortie rates, combat losses, and consumption per hour. For the year 1944, the world-wide estimates for the Army Air Forces as contrasted to actual reported consumption were 95.55% accurate.

The Production and Facilities Section was organized to assure quick completion of refinery facilities needed to manufacture required quantities of 100 oct. gasoline. It was originally staffed by Lt. Col. John H. Hennessy, a construction engineer of New York City, as chief. He was succeeded by Lt. Col. Paul G. Benedum of the Benedum-Trees Oil Co.

At the request of the Petroleum Administrator for War to the Under Secretary of War, this section was detailed to assist PAW in removing bottlenecks in the aviation gasoline refinery construction program. This was achieved through joint Army-Navy action by assigning officers to the various PAW districts for the purpose of assisting in the schedule and delivery of critical items of equipment and to assure adequate labor supply for refinery construction. These officers worked very closely with the oil companies and reduced "red tape" to a minimum.

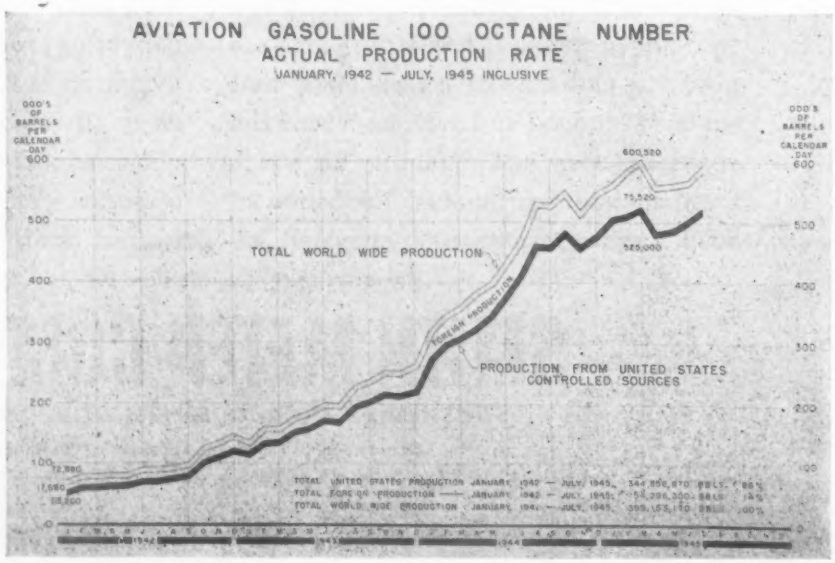
The success of this co-ordination between the oil industry, PAW, and the armed forces is attested by the fact that production of 100-oct. gasoline increased from 40,000 b/d at the start of hostilities to over 600,000 b/d before the war ended.

The Allocation and Distribution Section consisted of Col. Howze and Lt. Col. Gerken, who were originally assigned to the staff of the Army Air Forces to handle aviation petroleum. When Col. Howze was made chief of the Aviation Petroleum Branch, the section was augmented by the addition of Maj. Francis J. O'Brien, who joined the armed forces from the Tennessee Valley Authority.

Prior to 1941, distribution of aviation petroleum to the Army Air Forces' stations presented no serious problem. Stations within the Zone of Interior were supplied by direct tank-car and tank-wagon deliveries from sources of supply and normally handled through the distribution facilities of the various oil companies.

Requirements for offshore stations at that time were limited to Puerto Rico, Panama, Alaska, Hawaiian Islands, and the Philippines. These also were handled through commercial channels.

Early in 1942, projected operations indicated that such distribution would



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With much of our nation's oil reserves liquidated by war, ownership of crude oil will be vastly more important in the future. We have anticipated that situation and have greatly enlarged our land, geological and oil production departments. Our crude production has doubled since the beginning of the war. The result is that we now own and control enough production to supply our full refinery needs! That means: A dependable future supply of quality products for our jobbers, both old and new.

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no longer be feasible. A government-directed supply procedure was deemed essential to maintain control and allow complete co-ordination of supply between the Army and Navy in order to avoid duplication of shipments through a deficient transportation system.

The distribution of aviation petroleum had to be considered from a viewpoint of total requirements of a given theater and not as requirements of the individual services. The Allocation and Distribution Section, in conjunction with the Navy, delegated responsibility to either the Army Air Forces or the Navy. Thus the Army Air Forces supplied all the requirements for aviation petroleum in its designated areas, the Navy in its areas, and the other theaters were supplied by Lend-Lease.

Aviation fuels were delivered from production and not from inventories held by the services—no inventories of aviation fuels existed other than those volumes actually held in stock to meet delivery needs in combat theaters. Despite the fact that up to June, 1945, production failed to meet volumes required for allocation to meet consumption and essential stock levels, no single major combat operation was delayed through lack of aviation fuel in the combat zone.

However, to maintain projected operations within the combat areas, it was necessary to substitute grade 91/96 in the Zone of Interior in training and transport operations. The quantities of 91/96 substituted varied from 700,000 bbls. in July, 1943, to a peak of 2,140,000 bbls. in August, 1944. In the peak month of substitution, the Army Air Forces substituted 91/96 for 44% of its 100/130 aviation fuel requirements in the Zone of Interior. This was 87% of the total substitution made by the Army and Navy in the Zone of Interior.

To assure efficient operation of all productive and shipping facilities, it was necessary to secure periodic information concerning available stocks, past consumption and future requirements from areas of operation throughout the world.

The Aviation Petroleum Products Allocation Committee established co-ordinating committees in theaters of combined operations composed of representatives from the various services and commercial oil companies in these theaters, and Army-Navy Petroleum Board established Area Petroleum Offices in theaters of joint operations. These groups formed vast reporting networks.

Secured Oil Industry Aid

For the efficient functioning of these organizations, a great deal of assistance was sought and secured from petroleum industry representatives in the areas involved.

In addition to their normal duties, several officers of the Aviation Petroleum Branch were detailed to foreign duty to accomplish specific missions.

In 1943, Col. Howze, accompanied by a representative of the Navy Department, went to North Africa, where one of the first Area Petroleum Offices was established. He later visited the Caribbean Area and established another joint organization with headquarters in Panama. He went on similar missions to Canada and Hawaii. In 1944 he accompanied his Navy counterparts on a mission through Central Pacific and Southwest Pacific Theaters of Operation to improve over-all petroleum distribution and conserve critically needed tanker tonnage.

In October, 1945, Col. Howze, as representative of the Army-Navy Petroleum Board, went to the European Theater of Operations to determine final accounting between the services and to insure properly co-ordinated post-war distribution of petroleum products.

In 1944, Lt. Col. Paul E. Benedum was instrumental in expediting the completion of critically needed refinery facilities in the Caribbean Area, as the result of an on-the-spot survey accomplished in Curacao, which involved work through the Caribbean islands.

At the request of the U. S. Strategic Air Forces in Europe, in February, 1945, Lt. Col. H. Claire Dees accompanied an intelligence mission through Europe where scientific data of importance to the American Petroleum industry was secured by interrogation of technical representatives of the German petroleum industry. At the request of the Office of the Secretary of War in October, 1945, Col. Dees went to Japan on a bombing survey.

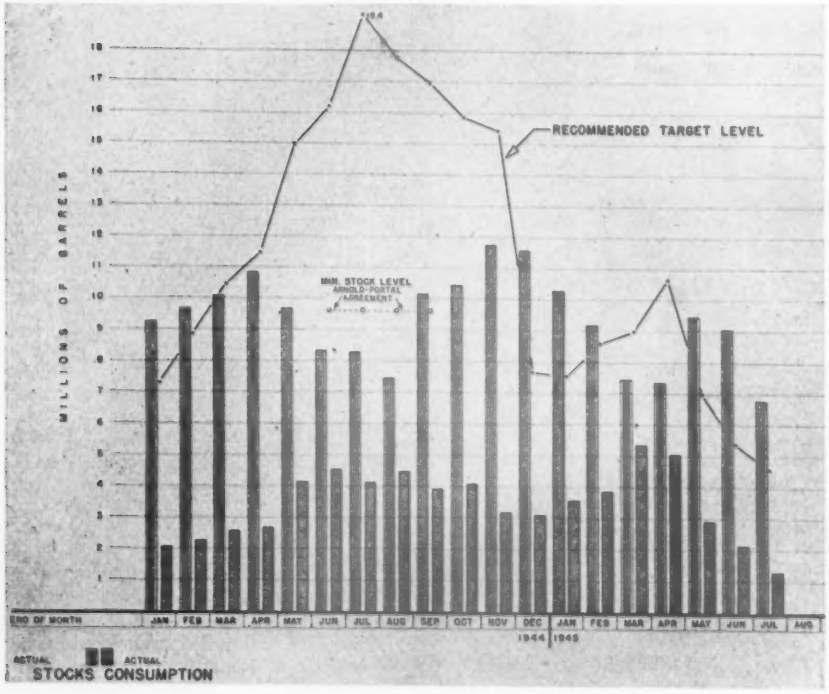
In July, 1944, Lt. Col. Gerken represented the Army Air Forces on a mission through the Caribbean Area and South America where a more efficient co-ordination of petroleum requirements by all using services was achieved. In November, 1945, the Adjutant General appointed him to a board of officers which traveled through Northwest Canada and Alaska. This group recommended a post-war system for supplying petroleum products to Army installations in those areas.

The latest development in the Washington petroleum picture in which the Aviation Petroleum Branch was involved has been the formation of the Joint Army-Navy Petroleum Purchase Agency. It is anticipated that this group, having representation from the Army Air Forces, the Office of the Quartermaster General, and the Navy Department, will ultimately co-ordinate their world-wide requirements of all petroleum products and contract for such materiel as a group and not by individual services as heretofore.

Recommends Stock for Future

As a result of its wartime experience, the Aviation Petroleum Branch has recommended that in the future a strategic reserve in the form of rotating stock be maintained at a substantial volume of the latest approved specification fuel. This volume to be in relation to the planned rate of air force expansion to provide a fuel supply for increased operations, in case an emergency arises, until production can be increased to full stream.

STOCK POSITION, CONSUMPTION AND TARGET LEVEL
EUROPEAN THEATER
(Including Iceland)


RECOMMENDED TARGET LEVEL
MIN. STOCK LEVEL ARNOLD-PORTAL AGREEMENT
MILLIONS OF BARRELS
END OF MONTH
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG
1944 1945
ACTUAL STOCKS
ACTUAL CONSUMPTION

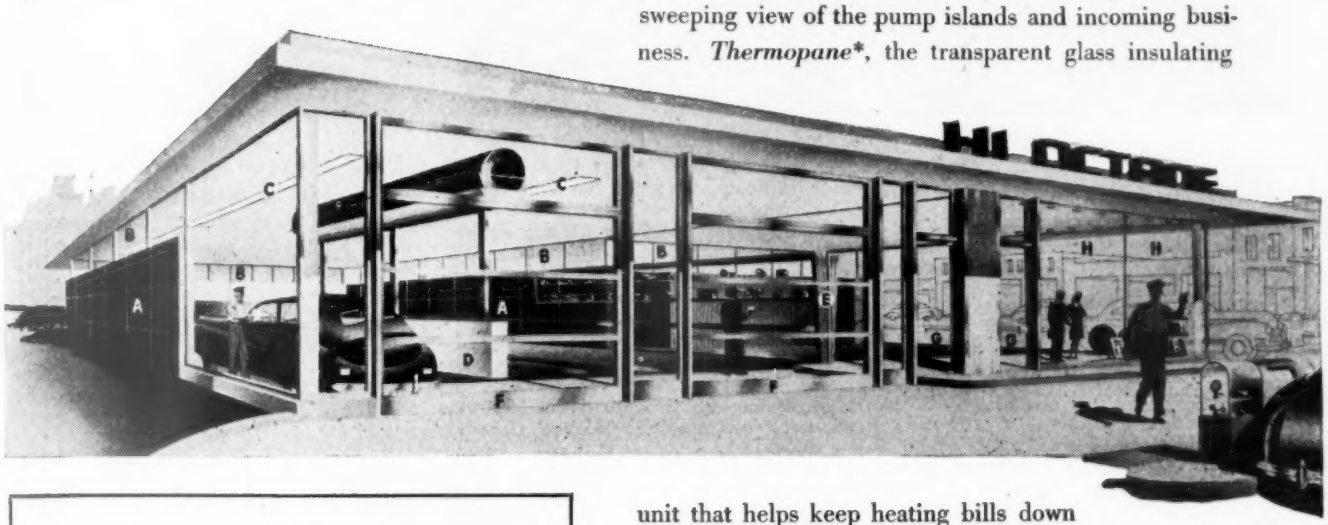
To increase buying increase seeing!

...with a VISUAL FRONT

Suggestions lead to sales. Why not suggest visually—by placing before the eyes of customers your accessories and extra services?

The Visual Front lets customers at the pumps see *into* the station, where merchandise is colorfully displayed. It takes the wraps off lubrication, washing and other service rooms, so customers can see work being done and consider it for their own cars.

There are management benefits, too. Glass partitions enable the station manager to keep an eye on the service rooms. And the clear glass front gives him a sweeping view of the pump islands and incoming business. *Thermopane**, the transparent glass insulating unit that helps keep heating bills down and reduces the possibility of condensation on glass, is ideal for visual service stations.



SOME INTERESTING DESIGN FEATURES OF THIS VISUAL FRONT

- **A.** *Glastone** outside and inside walls. Beautiful, colorful, easy to clean.
- **B.** Clerestory windows bring in light without sacrificing wall space inside.
- **C.** Lighting fixtures recessed behind Blue Ridge Glass panels.
- **D.** White *Vitrolite** base for tire rack.
- **E.** Plate glass screens between station rooms permit visibility.
- **F.** Metal overhead doors glazed with clear glass.
- **G.** Metal-framed plate glass doors.
- **H.** *Thermopane* in large glass areas—saves heat—provides better vision.

The Visual Front takes advantage of many practical qualities of glass. Its transparency. Its ease of cleaning. And, because glass has such a hard, weather-resistant surface, there's no need for refinishing.

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VISUAL FRONT

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Welcome Back . . . . . .

Four years ago Anthony F. Reynolds, sales representative for the Remington Oil Co., Reading, Pa., was given a farewell dinner by 18 of his friends as he entered the Army. These same 18 friends are shown here as they honor him upon his return. Harvey Remington, company head, was host. Mr. Reynolds was a staff sergeant and served in China-Burma-India theater. He returned Jan. 1 wearing the Asiatic-Pacific ribbon with two stars, the Victory ribbon, the American Defense ribbon, and the Good Conduct ribbon. Shown at the welcome home banquet are: front row seated, left to right—Stanley Adams, Raymond Tobias, Frank Guinn, Stanley Wentzel, Ed Chaffey, Phil Chollet; rear row standing, left to right—Mr. Reynolds, H. F. Remington, Jr., Earl Lawrence, Allen McDowell, Daniel Ancona, John Bertolet, Ed Burkart; rear row seated, left to right—Harold Miller, Victor Homan, Ellis Pierson, Herman Fischer, Orville Keenan, Sam Murdock, Henry Perella and Gene Keefer

Among oil people back on the job and attending the Kentucky Petroleum Marketers Assn. annual convention at Louisville Feb. 19-20 were:

S. T. "Jack" Pruitt, assistant division manager for Ethyl Corp., Dayton. Mr. Pruitt, who served as a major in the air corps, spent 19 months in the Southwestern and Western Pacific theater. In addition to his unit receiving the Presidential Unit Citation, Maj. Pruitt also wore the Asiatic-Pacific ribbon with four battle stars.

Also representing Dayton at the convention was **Lt. Col. J. P. Gentry,** who served 3½ years on the general staff of AAF in the European theater. The colonel can point to six battle stars acquired in World War II, and three in World War I, plus four commendations. In this war his operations as an air corps officer took him to northern and southern France, Normandy, Romearno, and the Italian campaign air offensive. Col. Gentry is assistant to the president of Joyce-Gridland Co.

Former Air Corps **First Lieutenant James S. Van Pelt** of LaPorte, now a sales engineer with Berry Asphalt Co., was greeting his old friends at the convention. Mr. Van Pelt spent two years and seven months in the service; one year as recruiting and induction officer at Indianapolis, and the balance of the time at Camp Davis, N. C., and Fort Bliss, Tex.

Former **Lt. (jg) E. Boyne Wood** has received his discharge from the U. S. Naval Reserve and returned to Lexington and rejoined the South Ky. Pipe Line Co.

Lt. Wood served 13 months at Little Creek, and Camp Bradford, Va., before going overseas where he served ten months in the European and Pacific theaters.

° ° °

Back in Lexington after four months' service in the infantry is **Barney Offield,** owner of the Barney Offield Oil Co. Mr. Offield was stationed at Camp Grant, Ill., and Fort Benning, Ga.

Robert B. Stewart, who recently returned to Aetna Oil Co., Louisville, as advertising manager, after eight months service in the South Pacific, joined the May-Kachler Co., Kentucky Willys distributors, March 1.

Mr. Stewart, who served a year and eight months in this country before going overseas, has ribbons indicating the award of a good conduct medal, service in the South Pacific and the Philippine liberation, with four bronze stars. He received two commendations.

Capt. Hubert J. Morgan, after two years' service overseas, where he received four battle stars, has joined the National Transit Co. as traffic manager.

° ° °

Lt. Col. I. U. Ball, after three years' service in the Army, has returned to civilian life and his former association with Standard Oil Co. of Louisiana, Baton Rouge, La. The colonel entered the Army in January, 1943, went through the oil school at Claibourne, La., and went overseas in September, 1943. He spent most of his time overseas on pipeline projects in the Mediterranean Theater, including North Africa, Italy and southern France (see NPN, April 11, 1945, p. 26).

Lt. Col. Ball had 25 years experience in the oil industry when he donned the uniform. He was in the mechanical engineering branch of Louisiana Standard, specializing in refinery design and construction.

° ° °

Lt. Alvin J. "Hap" Rhian, Yankton, S. D., Conoco jobber, has received his discharge after rounding out 34 months with the Army. While in uniform Lt. Rhian served in the Utility Maintenance Division of the Ordnance Department. He was overseas 24 months, most of the time in England and France. He received two battle stars.

During his absence, Mrs. Rhian managed his business, which he started in 1933 when he left Deep Rock Oil Corp. to form his own enterprise.

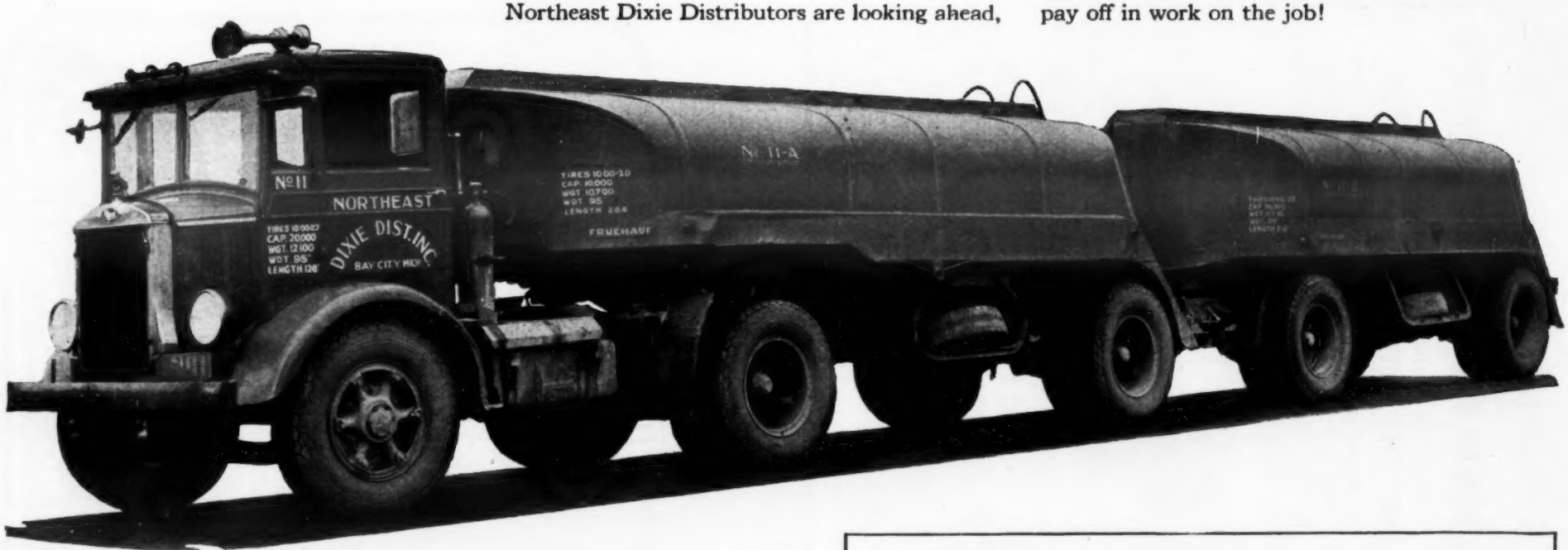
"Faithful NO. 11" has passed the Million Mile Mark . . .

Northeast Dixie Distributors bought their first Mack truck a decade ago. With well over a million miles rolled up at last count, she has become "Faithful No. 11."

They've bought more Macks since, but "Faithful No. 11" is still going strong. Her powerful engine is still pulling petroleum payloads averaging 7,000 gallons a trip.

Northeast Dixie Distributors are looking ahead, too. They say: "If any new equipment is purchased in the future it goes without being said that it will be Mack equipment . . . We feel that Mack not only makes good trucks but their ability to supply parts at a moment's notice is a definite point to consider when purchasing new trucks."

Macks are built to give you *extra work for your money*—fewer repairs and service interruptions—they cost much less in the long run. Macks pay off in work on the job!



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Write for Bulletin No. 102

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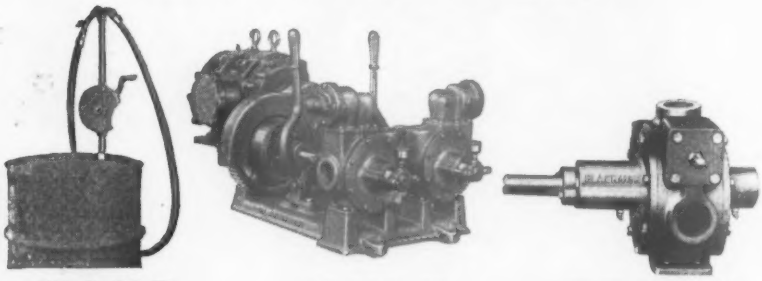

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WOOD RIVER OIL AND REFINING COMPANY, INC.

—— Welcome Back ——

Lieut. Col. Wayland W. Sweeney, Jr., is back with Ethyl Corp. as field engineer in the Atlanta Division. He was in the Army 4½ years. Col. Sweeney was graduated from the Army's Engineer School and the Command and General Staff School and served with the Engineer Corps in the states. Prior to joining the Army, Col. Sweeney was a safety engineer with Ethyl.

Again serving as field engineer with the Philadelphia Division of Ethyl is **Lieut. Marshall D. McDorman,** USNR. The lieutenant was in the Navy three years, serving two years in the Atlantic and Mediterranean areas.

Col. Howard B. Hudiburg, who was with the Coast Artillery Corps since entering the Army in May, 1941, has returned to his position in the sales department of Ethyl's Chicago Division. After three years' service in the states, Col. Hudiburg saw overseas duty in England, France, Belgium and Germany. He was awarded the Bronze Star for his meritorious work.

° ° °

Capt. H. I. Hoover, who aided **Col. Freeman W. Burford,** Headquarters, Channel Base Section, oil the war in Europe for 18 months, has returned to Phillips Petroleum Co. as superintendent of their East Chicago terminal. Three and half years ago when he left for the Army, he was chief chemist at the terminal. He has been with Phillips for 12 years. Jan. 2, he was discharged from the Army, the holder of two Battle Stars for engagements across the channel from England.

° ° °

Lt. Col. N. W. Faust, a member of the Fuels and Lubricants Branch, Research and Development Service, Army Ordnance Department, since May, 1942, is on terminal leave and preparing to return to The Texas Co. Twelve years with the company and assistant director of the grease research laboratory of its Port Arthur, Tex., works before he entered the Army, he now will go into the research department of its New York office.

° ° °

Maj. W. B. Bassett has been relieved of active duty in the Fuels and Lubricants Branch of the Ordnance Department's Research and Development Service and will enter the employ of Lubrizol Corp., Cleveland. Maj. Bassett, in the Army since 1942, first saw duty on the ordnance desert testing ground, and in the winter of 1942-43 engaged in fuels and lubricants test and development projects in Canada. Previously, he had been with Sinclair Refining Co. 10 years in development and sales departments.

° ° °

Sandford H. Black has returned to the Union Oil Co., Elizabethtown, Ky., after three years' service in the Navy.

GOVERNMENT-OWNED REFINERIES and ACCESSORY FACILITIES

FOR SALE OR LEASE

The War Assets Corporation, a subsidiary of RFC, has been designated as a disposal agency by the Surplus Property Administration and invites proposals for the purchase or lease of the following properties in the interest of continued employment. These properties were acquired by the government for production in the war effort, and are now, or shortly will be, declared surplus to government needs. Listing of these plants by name of lessee is for identification purposes only, and has no connection with the lessees' own plants or facilities.

These six refineries with storage facilities were built during the war to help meet the large requirements for 100 octane aviation gasoline.

Oil City, Pennsylvania (Plancor 1044)
Pennzoil Company

Two major refinery units and necessary auxiliaries for the production of 100 octane gasoline components. Area of site 8 4/5 acres. Approximate capacities are:

1. *HF Alkylation Unit: Capacity 1500 barrels of aviation alkylate per day.*
2. *Gas Concentration Unit: Capacity 850 barrels of base stock per day.*

Storage tankage:
Atmospheric: 123,000 barrels
Pressure: 13,000 barrels
Two sidings, Pennsylvania R. R.

●

El Dorado, Arkansas (Plancor 689)
Root Petroleum Corp.

A complete refinery with an operating capacity of about 1,990 barrels of 100 octane gasoline per day. Can be converted to the production of lower grade gasolines. Area of site, 7½ acres. Major functional units with approximate capacities are:

1. *Fluid Catalytic Cracking and Gas Concentration Unit. Capacity: 4,600 barrels of gas oil charge per day.*
2. *Butane Isomerization Unit. Capacity: 250 barrels of isobutane per day.*
3. *HF Alkylation Unit. Capacity: 1,300 barrels of aviation alkylate per day.*

Storage tankage:
Atmospheric: 234,000 barrels
Pressure: 22,000 barrels
Missouri Pacific R. R. siding.

●

Catlettsburg, Kentucky (Plancor 1067)
Ashland Oil & Refining Co.

A refinery with operating capacity of about 5,300 barrels of 100 octane gasoline per day. Area of site 101 acres. Major operating units with approximate capacities are:

1. *Thermofor Catalytic Cracking and Treating Unit, and Gas Concentration or Feed Preparation Unit. Capacity: 10,000 barrels of virgin gas oil or equivalent reduced crude per day.*
2. *HF Alkylation Unit. Capacity: 3,000 barrels of aviation alkylate per day.*
3. *Butane Isomerization Unit. Capacity: 1,300 barrels of isobutane per day.*

Storage tankage:
Atmospheric: 471,000 barrels
Pressure: 29,000 barrels
Chesapeake and Ohio R. R. spur.

●

Sweeny, Texas (Plancor 880)
J. S. Abercrombie Oil Co. & Harrison Oil Co.

Consists of refinery, 2 terminals, and 2 tank farms. Refinery has a rated capacity of about 8,500 barrels of 100 octane gasoline, 3,500 barrels of Army All Purpose Gasoline, and 1,700 barrels of 91 octane gasoline per day. Is readily convertible to production of other grade gasolines. Site consists of 7 parcels of land totalling approx. 508 acres. Operating units with approximate capacities are:

1. *Crude Topping Unit. Capacity: 22,000 barrels per day.*
2. *Thermal Reforming Unit. Capacity: 7,000 barrels per day.*
3. *Fluid Catalytic Cracking Unit. Capacity: 13,000 barrels of gas oil per day.*
4. *Gas Concentration Unit. Capacity: Consistent with operation of other units.*
5. *HF Alkylation Unit. Capacity: 4,000 barrels of depentanized alkylate per day.*
6. *Isomerization Unit. Capacity: 1,500 barrels of isobutane per day.*
7. *Acid Treating Unit. Capacity: Consistent with operations of other units.*

Storage tankage:
Atmospheric: 2,096,000 barrels
Pressure: 118,000 barrels
St. L. B. & M. R. R. siding. Oil loading docks at San Bernard and Freeport Terminals.

●

Cheyenne, Wyoming (Plancor 1146)
Frontier Refining Corp.

A complete refinery with designed capacity of about 1,650 barrels of 100 octane gasoline and approx. 1,300 barrels of motor gasoline per day. Area of site, 25 acres. Operating units with approximate capacities are:

1. *Crude Unit. Capacity: 2,200 barrels per day.*
2. *Reforming Unit. Capacity: 1,500 barrels per day.*
3. *Fluid Catalytic Cracking Unit: Capacity: 2,300 barrels of gas oil per day.*
4. *Butane Isomerization Unit. Capacity: 425 barrels of isobutane per day.*
5. *HF Alkylation Unit. Capacity: 1,100 barrels of depentanized alkylate per day.*
6. *Gas Concentration Unit. Capacity: Consistent with production of other units.*

Storage tankage:
Atmospheric: 250,000 barrels
Pressure: 16,000 barrels
Union Pacific R. R. siding.

●

Salt Lake City, Utah and Fort Laramie, Wyoming (Plancor 1164)
Utah Oil Refining Co.

Refinery at Salt Lake City, capacity about 5,500 barrels of 100 octane gasoline per day; can be converted to production of commercial grade gasolines. Area of site, 27¾ acres. Major units with approximate capacities are:

1. *Fluid Catalytic Cracking and Vapor Recovery Unit. AGAC Capacity: 8,500 barrels per day.*
2. *Sulfuric Acid Alkylation Unit. Capacity: 3,000 barrels aviation alkylate per day.*
3. *Butane Isomerization Unit. Capacity. 1,000 barrels per day.*
4. *Naphtha Fractionation Unit. Capacity: 5,000 barrels per day.*
5. *Naphtha Isomerization Unit. Capacity: 1,500 barrels per day.*
6. *Hydrogen Generation Unit. Capacity: 350 thousand cubic feet per day.*
7. *HCL Generation Unit. Capacity: Consistent with requirements of naphtha isomerization unit.*

Storage tankage:
Atmospheric: 410,000 barrels
Pressure: 57,000 barrels
Union Pacific R. R. siding.
FACILITIES AT FORT LARAMIE consist of special storage tankage:
Atmospheric: 25,000 barrels
Pressure: 15,000 barrels
Area of site, 4¾ acres.
C. B. & Q. R. R. siding.

OTHER GOVERNMENT-OWNED OIL REFINERIES ARE NOW, OR SHORTLY WILL BE, AVAILABLE FOR SALE OR LEASE.

Information regarding these plants is available in the Washington office of the War Assets Corporation and inquiries should be directed to the Plants Disposal Division. All data contained herein are necessarily abbreviated and subject to correction. They are not intended for use as a basis for negotiations. WAR ASSETS CORPORATION reserves the unqualified right to reject any or all proposals or offers received for the above properties.

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PLANTS DISPOSAL DIVISION

811 Vermont Avenue, N. W. Washington 25, D. C.

224T

Kentucky's Liberalized Truck Rules Promise Bigger Oil Markets

Kentucky, until February 20, 1946, with 66% of its communities not located on railroads, had America's most restrictive truck size and weight law. With an 18,000-lb. load limit the state was competing with neighboring states which allowed 42,000 lbs. or more.

Oil marketers were denied full payloads and economical truck hauls that similar railroadless districts had in other states. With the enactment of a liberalized weight limit law, and a bill providing for anti-diversion of tax collections, Kentucky is now in the process of shedding its nickname, "the detour state" and opening a new day in petroleum marketing.

By Herbert Taylor
NPN Staff Writer

LOUISVILLE, Ky.—Kentucky oil men attending the Kentucky Petroleum Marketers Assn. here Feb. 19-20 had ample reason to be jubilant when Gov. Simeon Willis signed the bill lifting Kentucky's load restrictions to the level prevailing among neighbor states.

The measure becomes effective Jan. 1, 1947, or at the end of the national emergency, whichever date is earlier. It gives to the commissioner of highways the right to designate such state and federal highways for use by trucks up to the maximums set as, in his opinion, are justified by strength, safety and durability of the highways.

The following table shows the present permissible maximums as compared with prewar standards:

	Permissible Maximum	Old Law
Height	12½ ft.	11½ ft.
Length single units	35 ft.	26½ ft.
Length semi-trailers	45 ft.	30 ft.
Gross weight	42,000 lbs.	18,000 lbs.
Axle load	18,000 lbs.	
Tire load	600 per in. width	

Full trailers not permitted

Licensing is changed to a gross weight basis from manufacturer's rated capacity. License fees are fixed so as not to materially change the cost of operating any truck of 18,000 lbs. gross or under, or any truck that does not operate more than 10 miles beyond limits of cities of the first, second, third or fourth class, or five miles beyond limits of cities of the fifth or sixth class.

The weight tax of $1 per 100 lbs. empty weight on for-hire trucks is replaced by gross weight fee ranging from $22 under 5000 lbs. to $300 for 39,001 to 42,000 lbs. Total fees, registration and gross weight, on for-hire vehicles range from $32 to $450. Private trucks carrying in excess of 18,000 lbs. are required to pay a weight tax ranging from $67 for 18,001 to 21,000 lbs., to $200 for 39,001 to 42,000 lbs. These weight fees, plus registration fees for private trucks, total $112 for 18,000 to 21,000, up to $350 for the maximum. The upper brackets break at 21, 24, 27, 30, 33, 36 and 39,000 lbs.

Under the law, oil marketers operating on roads designated by the commissioner of highways as justifying the maximun load will be able to transport 4000 gals.; those designated as limited to 28,000 lbs. will permit carrying of 2700 gals., and those designated as being able to take only the minimum of 18,000 lbs. may carry a load of 1600 gals.

Oil men point out that even with the new limit, Kentucky will not introduce an unprecedented high load scale. Missouri and Arkansas have weight limits of 53,000 lbs., Alabama and Georgia have 53,900. Tennessee and Mississippi are below Kentucky with 30,000 while Indiana permits 50,000, Illinois 72,000 and Ohio 69,000.

For-hire truckers complain that under this new law they are unable to develop a mileage rate basis. They must set up a point-to-point scale which is governed by the type of roads between points of delivery.

Independent marketers generally believe that the liberalized trucking law will result in a change in marketing policies by the major companies. They see the elimination of smaller storage tanks and a possibility of bulk plants being built at strategic locations on class one highways as "feeders" for deliveries with smaller trucking units on highways not designated as class one.

See New Era in Marketing

Oil men also see a new era in Kentucky marketing operations, not only because of more efficient truck operation, but because of the current outlook for expansion of Kentucky's highway system which will open many of Kentucky's 2962 railroadless communities for expansion of all kinds of business, hitherto impossible under prevailing conditions.

Kentucky will have for expenditure during the next two years on its highway system approximately $60,000,000. The state already has launched its postwar highway construction program. By March, 1947, plans call for highway work amounting to about $30,000,000.

They foresee an expansion of the state's petroleum refineries. There are now eight plants located in Louisville, Latonia, Somerset and near Ashland. Tank trucks haul 34% of the finished petroleum products from these refineries. With a liberalized trucking law, the way is opened for expansion.

Producers see in the enactment of the bill an incentive for further development of Kentucky's oil fields. More efficient truck operation in hauling of drilling equipment, supplies and machinery to the wells will leave more money for exploration.

Nor will the benefits be restricted to the petroleum field. Oil marketers stand to gain from the expansion of activities in other branches of industry insofar as highway transport is expected to increase in ratio to the expansion.

Those who are inclined to believe that the increase in load limits will deter the state's development because of additional building and maintenance costs for highways, are reminded by progressive Kentuckians of the results of a study made by the Kentucky Division of Planning of three one-mile sections in three of Kentucky's main traveled highways.

The study was a part of a report of the Kentucky Postwar Advisory Planning Commission, sparked by Paul G. Blazer, chairman of the board of Ashland Oil and Refining Co., and Herbert L. Clay, secretary of Kentucky Petroleum Marketers Assn. It set up the annual charge for the construction and maintanence costs of the three sections studied.

The revenues derived from these sections were calculated. Deductions of the annual costs from the revenue then showed that each mile studied produced a sizeable surplus for the state's use in extending less traveled highways. The study also showed the importance of encouraging maximum highway use. The mile on U. S. Highway 60 carried an annual cost of more than $500 more than the mile on U. S. 31-W, but the heavier traffic on 31-W resulted in a $7000 higher annual revenue.

The studies were used by the planning commission as evidence that improved highways where traffic is encouraged, not only pay their way but benefit the citizens of the entire state by providing revenues far beyond their cost.

New Licensing on Gross Weight Basis Replacing the Former Manufacturers' Rated Capacity Basis

Gross Wt.	License (all trucks)	Wt. Fee (private)	Total (private)	Wt. Fee (for hire)	Total (for hire)
0- 5,000	$ 10	...	$ 10	$ 22	$ 32
5,001- 8,000	22	...	22	39	61
8,001-10,000	25	...	25	48	73
10,001-12,000	29	...	29	52	81
12,001-14,000	32	...	32	57	89
14,001-16,000	36	...	36	62	98
16,001-18,000	40	...	40	70	110
18,001-21,000	45	$ 67	112	101	146
21,001-24,000	50	84	134	132	182
24,001-27,000	59	97	156	161	220
27,001-30,000	71	113	184	185	256
30,001-33,000	85	130	215	208	293
33,001-36,000	101	148	249	235	336
36,001-39,000	123	170	298	272	395
39,001-42,000	150	200	350	300	450

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Western Petroleum Refiners Convention Program Is Set

NPN News Bureau

TULSA—Western Petroleum Refiners Assn., holding its 34th annual meeting at the Blackstone Hotel in Fort Worth March 25-27, will present outstanding speakers who will discuss problems in refining, taxes and business in general.

Technical sessions will be held March 26 and 27, starting at 9:30 a.m. General sessions on these days will begin at 2 p.m. Chairman for the general session on the 26th will be Roland V. Rodman, vice president, Bay Petroleum Co., Denver. Col. E. O. Thompson, Texas Railroad Commission, representing the governor, will deliver the address of welcome.

Other speakers and their topics are:

Robert Ash, Washington counsel, Prentice-Hall, Inc., New York—"Tax Prospects in 1946."

R. R. Wason, president, National Assn. of Manufacturers, New York—he will present the manufacturer's views for the future.

W. J. Brons, chief editorial writer of "The Round Table" column, Chicago Journal of Commerce—"How Good Is Debt?"

A. J. Pettigrove, member of petroleum mission recently sent to Japan and Southwest Pacific to study Japanese oil installations.

The evening of the 25th a buffet supper is scheduled and on the evening of the 26th a buffet dinner and annual spring roundup party will be held. The annual dinner and dance of the association is scheduled for the 27th.

2 Plants Win Safety Awards

NPN News Bureau

SAN FRANCISCO—Two of Standard of California's El Segundo refinery units have been awarded Department of Labor safety certificates for reduction of accidental injuries to employes by 67% in the butadiene plant and 53% in the filling and shipping plant during the first six months of 1945.

Science Foundation Bill Compromise Between Federal Setup and One Directed by Scientists

By V. B. Guthrie
Editor, NPN Technical Section

CLEVELAND—The new National Science Foundation bill (S 1850) introduced in Senate Feb. 21 is a compromise between a federally co-ordinated research program directed by government officials and one directed chiefly by scientists of the nation.

Like most compromise bills, no one is in full agreement with its terms, but it is not believed that a better measure can be prepared reconciling the views of the two groups. Quick action on the new bill is being urged, since the Office of Scientific Research and Development, the federal agency which co-ordinated research work during the war, terminates its activities June 30. One section transfers this agency to the foundation set up in the new bill.

The new National Science Foundation bill was perfected jointly by the subcommittees of the Senate Military Affairs Committee Considering Science Legislation and of the Senate Commerce Committee Considering Science Legislation. Sen. Harley M. Kilgore, West Virginia, is chairman of the former. He sponsored one bill introduced in Congress last August when it was first proposed to coordinate basic research work in the interests of national defense and public welfare under government supervision. His bill placed the direction of the program in a board consisting of the heads of other government departments and agencies. Sen. Kilgore also proposed that all inventions and discoveries made in the course of research projects in any way financed by the government become public property.

Sen. Warren G. Magnuson, Washington, is chairman of the subcommittee of the Senate Commerce Committee which also studied the need for science legislation. His bill, introduced concurrently last August with the Kilgore bill, placed the direction of the research program in a board of nine scientists appointed by the President, not holding any other government office. The Magnuson bill was patterned on a report of Dr. Vannevar Bush, director of the Office of Scientific Research and Development, and a group of prominent scientists. They proposed that patent arrangements be left to the discretion of the board administering the national research program.

Quotes Joint Statement

A joint statement of the two subcommittees issued at the time the new National Science Foundation bill was introduced in Congress stated:

"In the opinion of both subcommittees, the new science bill represents a great improvement over previous proposals and the bill has already received wide support from scientists and other groups. The perfected bill is the product of extensive hearings and many subsequent conferences between scientists and subcommittee members. The bill meets the objectives for science legislation set forth by President Truman in his message to Congress on Sept. 6, 1945."

The new measure gets around one point of difference between the two former bills by proposing that the Science Foundation be administered by parallel staffs of full time government officials and part-time scientific personnel. The full time staff would include an administrator, appointed by the President and paid $15,000 a year, and a deputy administrator. Within the foundation there would be not to exceed nine divisions, each with a full time director.

Advising the administrator would be a National Science Board of nine members appointed by the President and approved by the Senate "from among persons who are especially qualified to promote the broad objectives of the act." The board is to continuously survey the activities and management of the foundation and periodically evaluate its achievements. A statement of the Kilgore subcommittee says on this point:

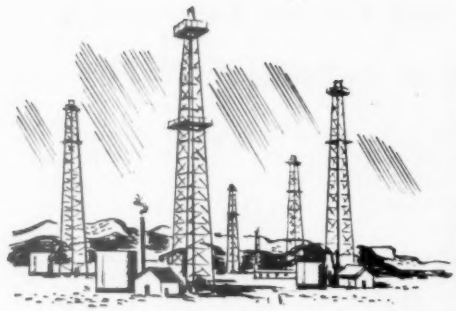
"While it is believed that these two groups will normally work together harmoniously, provision is made whereby each serves as a continual check on the other, thus increasing the probability that the Foundation will at all times remain equally responsible to the needs of both scientists and the general public."

As regards patents the Kilgore report states that the new bill contains no provision for modification of existing patent laws or the right of any individual or corporation to patent, hold, transfer or exploit privately developed inventions.

Provisions of Bill

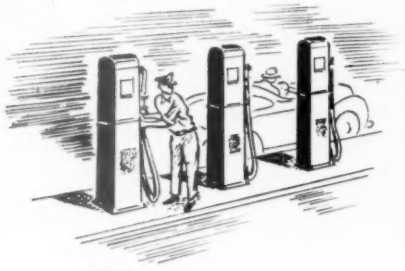
The bill's provisions set forth the basic principles: (1) That the results of research fully financed by the federal government, whether patentable or nonpatentable, should ordinarily be made freely available to the public (2) that where a private organization undertaking by contract a research project for federal agencies, has contributed substantially to a particular invention or discovery through earlier or current research activity financed by that organization, the private organization may retain such portion of the commercial rights as will be agreed upon as being equitable. In the application of the second principle commercial rights may be retained by nonprofit institutions as well as commercial organizations.

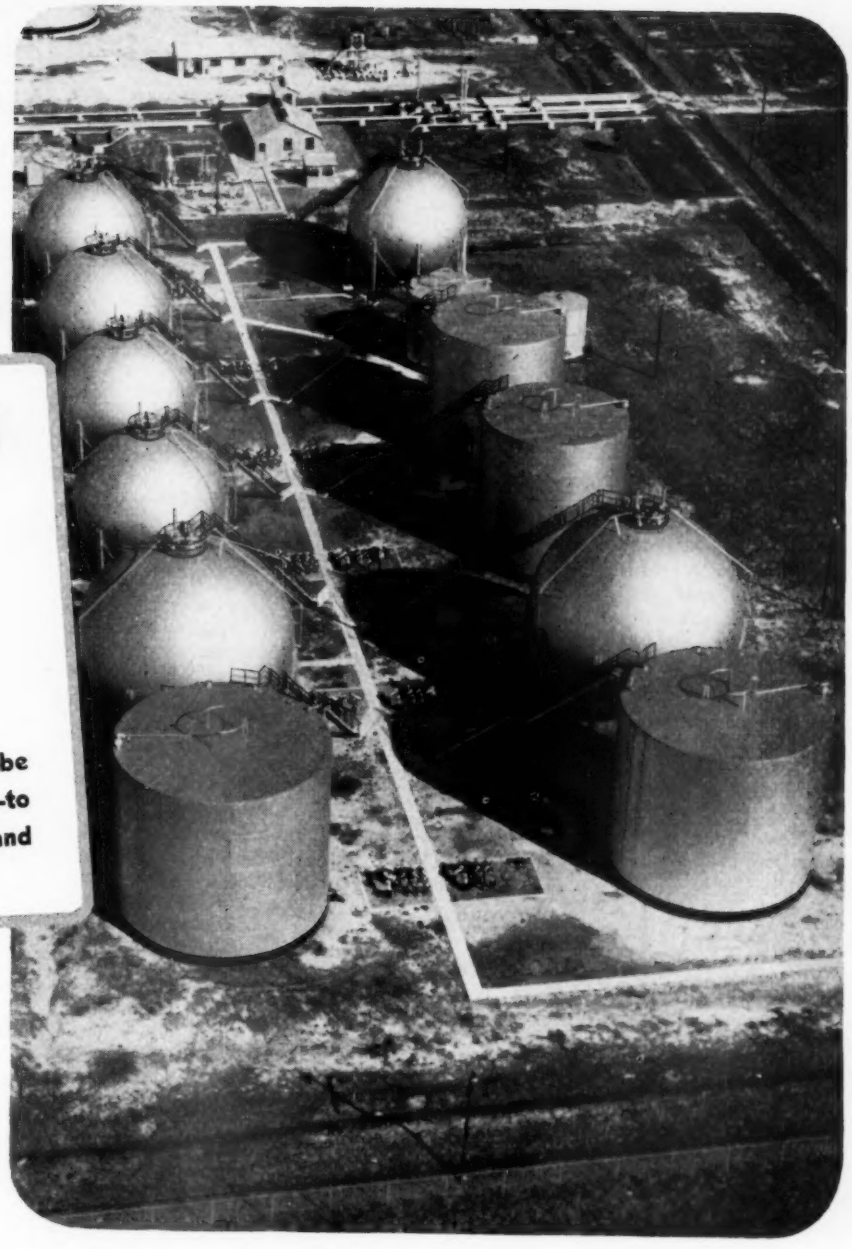
Another important matter covered in this section of the new bill is the establishment of a procedure for handling inventions now owned by the federal government. "Because the government agencies have had to date no well defined policy in this field, many questions have been raised concerning the proper use of government-owned patent," the report states. The bill provides that all inven-



...from field to filling station

. . . volatile products must be protected from evaporation—to assure maximum throughput and maximum profits.





THE photo at the right shows some of the storage facilities at a cycling plant in Texas where 16,000 bbls. of butane, 250° end-point gasoline and heavy distillate are recovered daily. In this view there are five 5,000-bbl. Hortonspheres—two designed for 80 lbs. per sq. in. pressure and three for 25 lbs. pressure—and two 10,000 bbl. Hortonspheres—one designed for 25 lbs. pressure and the other for 80 lbs. The flat-bottom tanks shown include a 1,000-bbl., two 7,500-bbl. and two 10,000-bbl. units.

Hortonspheres are the logical choice for storing petroleum products that are highly volatile. They are designed to operate at higher pressure than the vapor pressure (during normal temperature range) of the product being stored. Instead of a portion of the air-vapor mixture being expelled from the tank when temperatures rise—pressure builds up inside. Hence, during normal operations no vapor loss occurs.

All of the tanks shown in the accompanying view were designed, fabricated and erected by us. We also build Hortonspheroids, *large capacity* storage tanks in capacities up to 120,000 bbls. for products ranging in volatility from motor gasoline to natural gasoline and Hemispheroids, *small capacity* pressure tanks for volatile products that require operating pressures up to 5 lbs. per sq. in.

Write our nearest office for quotations on all of your storage tank requirements.

CHICAGO BRIDGE & IRON COMPANY

Birmingham 1.....1534 North Fiftieth Street
Houston 1.....5618 Clinton Drive
Tulsa 3.....1607 Hunt Building
New York 6.....3345-165 Broadway Building
Cleveland 16.....2206 Guildhall Building
Atlanta 3.....2150 Healey Building

Chicago 4.....2125 McCormick Building
San Francisco 11.....1260-22 Battery St. Building
Philadelphia 3.....1614-1700 Walnut St. Building
Los Angeles 14.....1422 Wm. Fox Building
Washington 4.....703 Atlantic Building
Detroit 26.....1513 Lafayette Building

Plants in BIRMINGHAM, CHICAGO and GREENVILLE, PENNSYLVANIA

tions now owned by the government shall be made freely available to the public, with the exception of those which the President or his designee decide should not be made public for national security reasons.

"The result of the passage of this legislation will be to make available to the public for immediate use many inventions now without security classification that came out of the war research work of the Office of Scientific Research and Development and other government agencies."

In regard to the expenditure of funds by the foundation for research projects, the bill provides that at least 50% shall be used to support research in nonprofit organizations (25% to be distributed on a geographical basis and 25% irrespective of the location of the organization submitting the research proposals). It is also provided that 25% of all research funds (excluding national defense) be apportioned to each state on an automatic formula to assure an equitable geographic distribution. It is brought out in the report accompanying the introduction of the bill that President Truman has recommended in his 1946 budget message $40,000,000 for the first fiscal year of the foundation's operation."

Press Early Passage Of New Science Bill

WASHINGTON—Senate Military Affairs and Commerce Committees has been asked by subcommittees to seek early enactment of a new bill (S. 1850) for creation of a national science foundation, sponsored by six Democratic and two Republican senators, which makes certain changes designed to meet objections offered to previous bills. (See NPN Feb. 27, 1946, p. 4).

Chairman Kilgore (D., W. Va.) of war mobilization subcommittee pointed out in his report to Military Affairs Committee that "no nation is stronger than its scientific resources" and "it is considered opinion of your subcommittee that full and balanced development of science in America cannot take place without broad national support contemplated in this legislation."

Sen. Kilgore said conclusion had been forced upon subcommittees by men who work in and manage existing scientific institutions of this country, that existing support of scientific activity in United States, is inadequate. In these conclusions, he said he was joined by Senate commerce subcommittee.

Report submitted by Chairman Magnuson (D., Wash.) of commerce subcommittee said it concurred in report of war mobilization subcommittee and said new bill (S. 1850) covered all phases of other bills dealing with scientific research now before commerce committee.

Rise in Foreign Demand and Heavy Automotive Use Keep Sales of Lubes at Refineries High

NPN News Bureau

CLEVELAND—Contrary to the opinion of many that the sale of lubricating oils at refineries would slacken with the end of the war, movement continues to be heavy at these points.

A survey by NPN reveals the three-fold reason:

1. Heavy automotive demand domestically, primarily due to need of high-grade lubrication for old cars.

2. Unexpectedly sharp pickup in postwar foreign demand.

3. Shortage of Pennsylvania crude.

Relative to heavy automotive demands, it is pointed out that average age of cars is eight years as against four years prewar. With lifting of gasoline rationing, every car owner is trying to operate a rundown auto which is using a lot of motor oil. Ratio of use of lubes to gasoline is up 20 to 25%.

Another factor contributing to automotive demand for higher-quality oils is fact that everybody has money to spend.

One oil company official in the East said that during the war, domestic service stations had to degrade quality. After V-J Day bulk and service stations began to stock up with better grades of oil in tremendous quantities. Meanwhile, strikes cut production while many refiners cut back operations because they were getting too much gasoline.

A Midwest oil man said situation calls for all lube yields possible to stock service stations in U. S., with a shortage being created by flow of lubes to United Kingdom for distribution to Sweden and France.

Foreign Demand Picks Up

Concerning export, consensus of opinion is that foreign demand revived more quickly than had been expected and foreign governments are buying heavily. An eastern oil official pointed out that the war's end found most suppliers denuded of stocks, particularly abroad. He also said surplus Army-Navy stocks in Europe were not as large as had been anticipated and comparatively little was released to civilians. The same situation prevailed in China.

India, Australia and New Zealand have surpluses but they still have not been released. Britain, France, China, Holland and Belgium are all reported heavy buyers, although only last week Etienne Dalemont, director of Groupement d'Achat des Carburants, denied reports that France has been making unusually heavy purchases of lubricating oils. He described present purchases as "moderate" in volume (see NPN Feb. 27, p. 13).

Shortage of Pennsylvania crude contributes substantially to currently tight situation. Reports indicate Pennsylvania does not have the necessary crude to work with, with runs very slow and jobbers begging for oil to meet demands. Western bright stocks and good neutrals are on the short side also.

Reduction in Lead for Gasoline Seen by CPA for 2nd Quarter

WASHINGTON—Second quarter lead allocations, due out in next week or so, may show a reduction in amount available for use in manufacture of tetraethyl fluid for motor fuel blending.

Possibility of a cut was forecast in monthly report on civilian production, issued by CPA Administrator John C. Small. Officials of CPA Metals and Minerals Division followed that up by stating that situation "is going to be tough." Requirements Committee has not yet met, however, pending more accurate information as to probable second quarter lead availability.

Lead allocation for motor fuel in first quarter was 10,000 tons—5,000 less than requested.

Making outlook for future dark is fact Mexican smelters have been struck since Jan. 1 and 18 U. S. plants are idle due to strikes, with no indications seen of early settlement. According to CPA, domestic lead production is off about 50%.

WAC Offers 24,625 Avgas Capacity for Sale, Lease

WASHINGTON — War Assets Corp. March 1, placed on sale or for lease six refineries with daily combined capacity of 24,625 bbls. of 100-octane aviation gasoline and 6500 bbls. of other grades of gasoline, together with storage facilities.

Refineries have been operated by following companies:

Utah Oil Refining Co., Salt Lake City and Ft. Laramie, Wyo., 5500 b/d 100-octane; Root Petroleum Corp., El Dorado, Ark., 1990 b/d 100-octane; Frontier Refining Corp., Cheyenne, Wyo., 1650 b/d 100-octane; Ashland Oil and Refining Co., Catlettsburg, Ky., 5300 b/d 100-octane; J. S. Abercrombie and Harrison Oil Co., Sweeny and Freeport, Tex., 8500 b/d of 100-octane, 3500 b/d of Army all-purpose gasoline and 1700 b/d of 91-octane; Pennzoil Co., Oil City, Pa., 1685 b/d 100-octane.

Offers Oklahoma Avgas Plant

WASHINGTON — The $14,398,000 government-built 100-octane refinery at Duncan, Okla., operated during the war by Associated Refineries, Inc., is being offered for sale or lease by War Assets Corp. Capacity is 4,200 b/d, but actual production has run as high as 5,100 b/d.

Refining News

Bureau of Mines Names Staff For Synthetic Fuels 'Lab'

NPN News Bureau

WASHINGTON—Bureau of Mines has appointed Dr. L. D. Schmidt, a chemist with experience in private industry and in the agency's Pittsburgh fuel laboratories, as director of its new synthetic liquid fuels laboratory at University of West Virginia, Morgantown. With a staff of 7 that eventually will be expanded to 20, Dr. Schmidt will direct a three-section research program to gather information that eventually will be applied in design of pilot plant and later demonstration plant gas-making equipment at Louisiana, Mo.

According to Bureau Director Dr. R. R. Sayers, research problems will be divided at lab along these lines:

In briquetting and coking section, which Dr. Schmidt will supervise in addition to his over-all responsibilities as chief of the laboratory, scientists will investigate coal briquetting, carbonization, oxidation, cleaning, and other pre-treatment methods in an effort to prepare suitable low-cost fuel for generating gases needed in production of synthetic oil and gasoline.

Research experts in gas-making processes section will test and classify American coals according to relative values in certain gas-making processes. Scientists will also test processes themselves, some of which were developed in Germany, and will investigate a method for producing hydrogen by inter-action of steam and iron at elevated temperatures as a possible source for hydrogen needed in synthetic fuels output.

Finally, gas treating and testing section will study methods of analyzing and purifying synthesis gas.

GCRA Reports Crude Runs To Stills 105,633 B/D

Special to NPN

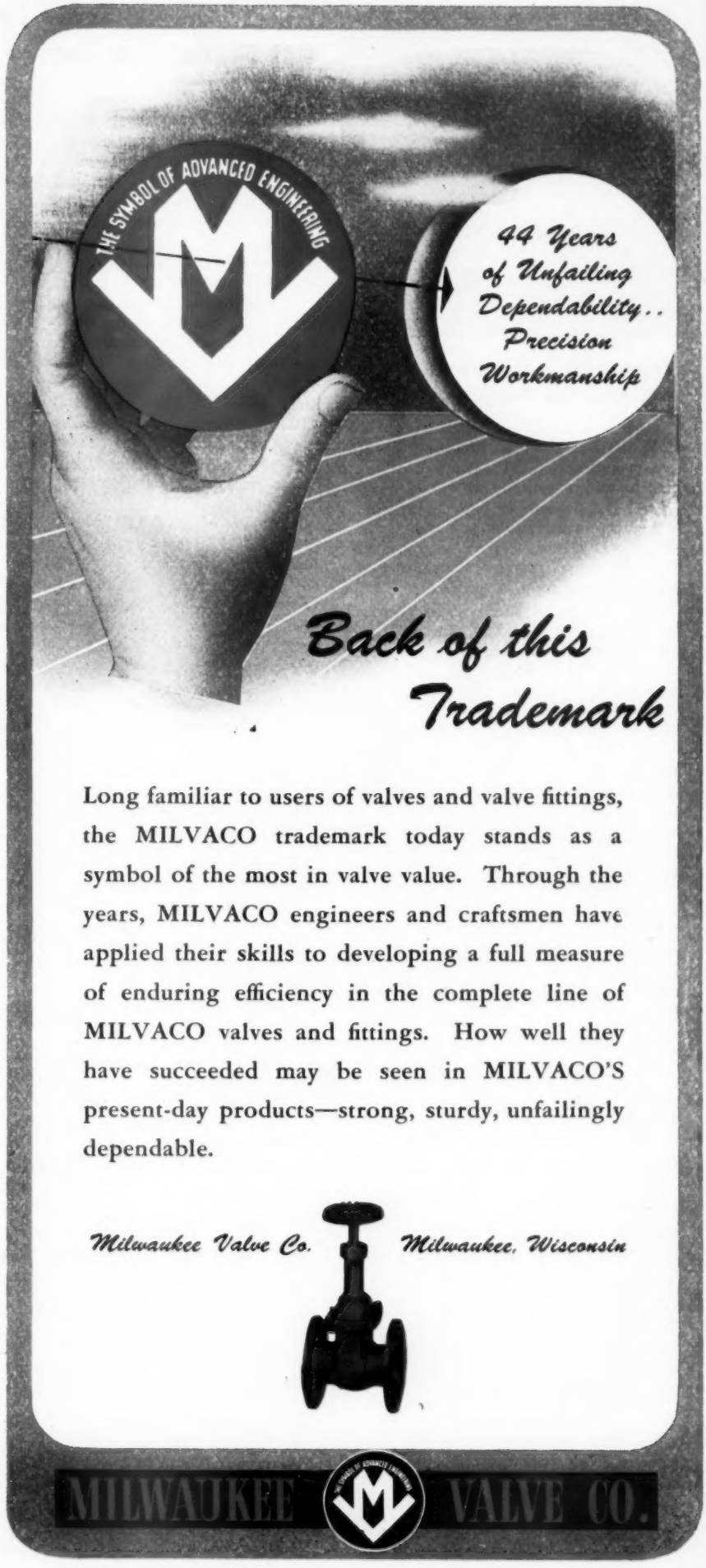
HOUSTON—Crude runs to stills totaling 105,633 b/d or 83.2% of rated operating capacity for 10 Texas Gulf Coast independent refineries was reported by Gulf Coast Refiners Assn. for the first half of February.

Stocks of all grades of gasoline and naphthas increased by 245,430 bbls. to total 2,080,588 bbls. Avgas stocks Feb. 15 were 362,034 bbls., an increase of 9438 bbls. as compared to Feb. 1 totals.

Motor Fuel from Farm Wastes

WASHINGTON—Annual report of USDA's Bureau of Agricultural and Industrial Chemistry states that research into chemical conversion of agricultural residues or "wastes" will move into semi-commercial scale production during present year.

Experimental investigations in Northern Laboratory at Peoria, Ill., report says, indicate that from 90 to 95 gals. of liquid motor fuel can be produced from ton of corn cobs or cottonseed hulls, with about half of this in form of ethyl alcohol.


THE SYMBOL OF ADVANCED ENGINEERING
44 Years of Unfailing Dependability.. Precision Workmanship
Back of this Trademark
Long familiar to users of valves and valve fittings, the MILVACO trademark today stands as a symbol of the most in valve value. Through the years, MILVACO engineers and craftsmen have applied their skills to developing a full measure of enduring efficiency in the complete line of MILVACO valves and fittings. How well they have succeeded may be seen in MILVACO'S present-day products—strong, sturdy, unfailingly dependable.
Milwaukee Valve Co. Milwaukee, Wisconsin
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Truman to Re-Examine Order Withdrawing Public Lands

NPN News Bureau

WASHINGTON — President Truman has promised Sen. McCarran (D., Nev.) that he will re-examine an executive order issued last September which reserved to the government, and prohibited disposal of, all public lands which contain deposits of radio-active mineral substances, and all deposits of such substances.

Sen. McCarran had pointed out in a a letter to the President dated Feb. 23 that practically all public lands contain mineral substances that are radio-active in some small degree, and said the order has had the effect of halting all exploration and development on public lands.

Sen. McCarran said he was informed that all oil wells as well as virtually all coal in mines and all minerals containing potash, are radio-active. It is probably safe to say, he added, that there is not a square mile of surface that does not contain radio-active minerals.

President Truman replied that the intent of the order is "merely to protect the United States and world against promiscuous use of material which can be easily translated into atomic energy" and that, of course, there is no intention to hamper legitimate mining business.

Crude Oil Reserves Increase in 1945 But Production Due to Drop, API Says

NPN News Bureau

NEW YORK—Though U. S. proved oil reserves showed substantial gain in 1945 despite record crude oil production of 1,736,717,000 bbls. (see NPN Feb 27, p. 4), the Committee on Petroleum Reserves of American Petroleum Institute in its report contained a warning against over-optimistic speculation on future production.

The committee points out that today's known oil can be recovered only over a period of many years and at gradually declining annual rates. This has been widely demonstrated by past performance under all kinds of operating conditions. Therefore, only incorrect conclusions as to the life of these estimated reserves can be obtained by dividing these reserves by the current rate of production.

Estimate of 20,453,231,100 bbls. (below) proved reserves as of Dec. 31, 1945, refers solely to proved or blocked-out reserves of crude, including condensate, produced as oil on the lease or through cycling plants, the committee states. (See table below). They include only oil recoverable under existing economic and operating conditions. The estimates in the API report do not include:

1. Casinghead gasoline extracted at natural gasoline plants, though these probably will be available next year.

2. Oil under the unproved portions of partly developed fields.

3. Oil in untested prospects.

4. Oil that may be present in unknown prospects in regions believed to be generally favorable.

5. Oil that may become available by secondary-recovery methods from fields where such methods have not yet been applied.

6. Oil that may become available through chemical processing of natural gas.

7. Oil that can be made from oil shale, coal, or other substitutes.

Proved reserves are both drilled and undrilled. The proved drilled reserves in any pool, include the oil estimated to be recoverable by production systems now in operation, whether primary or secondary, and from the area actually drilled up on the spacing pattern in vogue in that pool.

The proved undrilled reserves, in any pool, include reserves under undrilled spacing units which are so close, and so related, to the drilled units that there is every reasonable probability that they will produce when drilled.

In the case of new discoveries, which are seldom fully developed in the first year and in fact for several years thereafter, the estimates of proved reserves necessarily represent but a part of the reserves which may ultimately be assigned to the new reservoirs discovered each year.

The report points out the total of new oil through discoveries estimated as proved in any given year is comparatively small and the total of new oil through extensions is comparatively large. As knowledge of the factors affecting production and well performance become available, and as these factors are studied, reserves in older fields can be estimated with greater precision and revised accordingly. Therefore, the oil assigned to new discoveries, plus the oil proved through extensions, comprises the total quantity of the new proved reserves for the year.

The committee report stressed the fact that its estimates of proved reserves cannot be used as a measure of the rate

TABLE 1—Estimated Proved Petroleum Reserves in the United States

(Barrels of 42 U. S. Gallons, 000 Omitted)

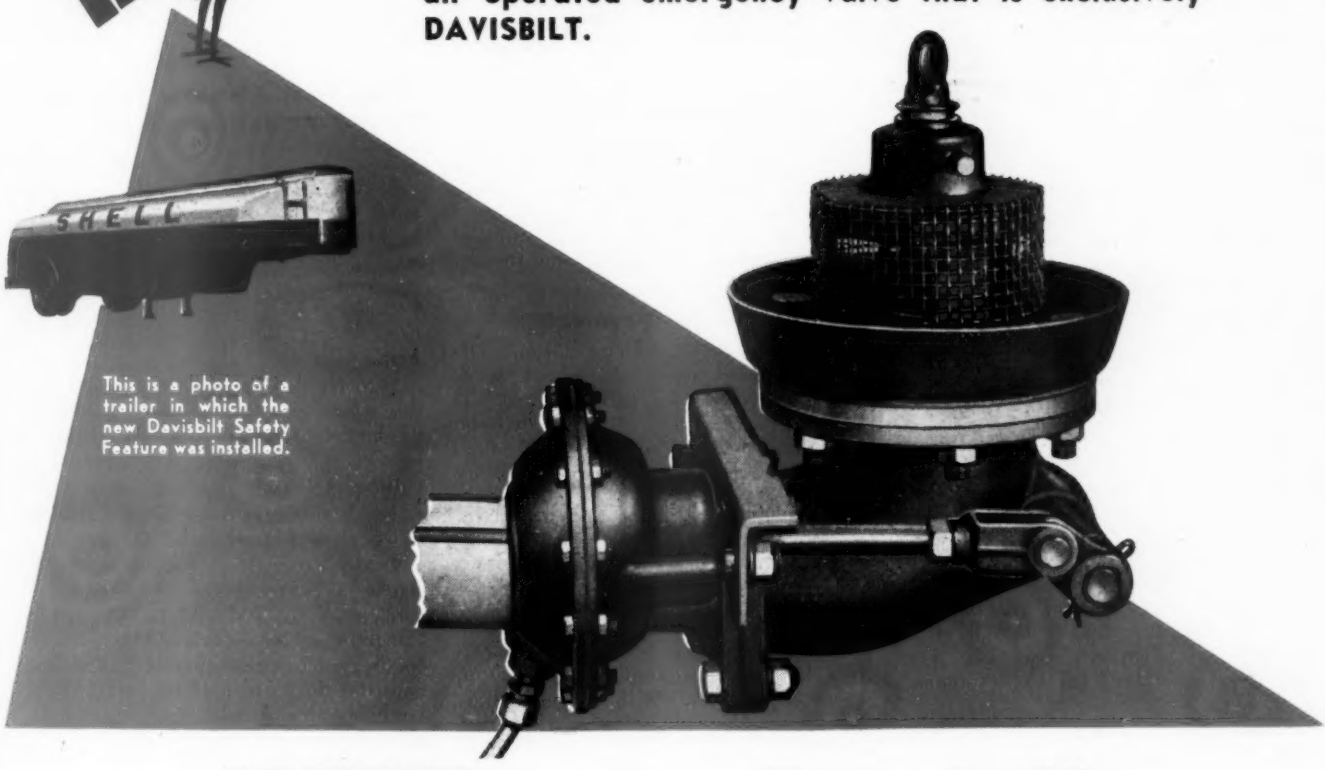
	Proved Reserves as of December 31, 1944	Changes in Proved Reserves due to Extensions (New Oil) and Revisions during 1945	Proved Reserves in New Pools Discovered in 1945*	Production During 1945 (Estimated)	Proved Reserves as of December 31, 1945 (Columns 1+2+3 less Column 4)
	(1)	(2)	(3)	(4)	(5)
Alabama	317	639	.....	171	785
Arkansas	293,059	38,401	810	28,596	303,674
California	3,344,552	328,586	63,254	326,444	3,409,948
Colorado	88,823	175,971	.....	4,964	259,830
Illinois	320,714	92,833	11,221	75,148	349,620
Indiana	31,493	13,597	1,009	4,856	41,243
Kansas	601,751	26,252	10,165	96,322	541,846
Kentucky	41,080	22,815	3,169	10,343	56,721
Louisiana	1,573,387	204,609	47,550	135,765	1,689,781
Michigan	65,134	16,023	304	17,275	64,186
Mississippi	209,011	69,292	7,659	18,802	267,160
Montana	111,650	4,633	535	8,344	108,474
Nebraska	581	221	.....	302	500
New Mexico	562,564	(—)20,763	7,933	37,361	512,373
New York	85,831	.....	.....	4,642	81,189
Ohio	31,624	907	.....	2,850	29,681
Oklahoma	970,262	35,621	22,175	138,219	889,839
Pennsylvania	123,138	.....	.....	12,537	110,601
Texas	11,375,480	628,895	241,207	775,288	11,470,294
West Virginia	40,755	750	.....	2,875	38,630
Wyoming	581,730	50,933	2,993	35,525	600,131
Miscellaneous**	295	100	.....	88	307
Total United States	20,453,231	1,690,315	419,984	1,736,717	20,826,813

*Only a limited area is assigned to each new discovery even though the committee may believe that eventually a much larger area will produce, for in this report the concern is only with actually proved reserves.

**Includes Florida, Missouri, Tennessee, Utah and Virginia.

MIND IF WE CROW?

We can't help feeling puffed up. We did it again . . . pioneered a revolutionary new safety feature . . . an air operated emergency valve that is exclusively DAVISBILT.



This is a photo of a trailer in which the new Davisbilt Safety Feature was installed.

SAFETY... at a finger's flip

No more Samson act to open the emergency valve. A child can operate the New Davisbilt Safety Valve. Just the flick of a little lever with one finger and compressed air does the heavy work.

No more worry about frayed cables breaking or hydraulic systems being "fresh out" just when you need them . . . BAD! With the new Davisbilt safety valve there is no possibility of leakage affecting efficient performance . . . no danger of fraying or breaking . . . and it's corrosion free.

For you maintenance minded men . . . it has ready accessability, positive action and minimum maintenance. It is connected to the air supply that activates the brakes . . . no separate compressor required . . . special back-pressure valve insures minimum 65# brake pressure . . . patented parts, interchangeable with standard Westinghouse operating diaphragm and control valve.

Brother . . . have we got something to crow about . . . you tell us.

SPECIALISTS ENGINEERING IN THE FIELD OF FLUID CARRIERS

DAVISBILT

THE DAVISBILT PRODUCTS COMPANY

Formerly The Davis Welding and Manufacturing Company

CINCINNATI, OHIO

TABLE 2—Summary of Committee's Annual Reports Covering Period 1937-1945

(Barrels of 42 U. S. Gallons, 000 Omitted)

	New Oil Blocked Out During Year					
	Through Revisions of Previous Estimates and Extensions to Known Fields	Through New Pools Discovered During Year	Total Through New Discoveries, Extensions and Revisions	Production During Year	Estimated Proved Reserves as of End of Year	Increase Over Previous Year
1936	.....	.....	.....	.....	13,063,400	.....
1937	2,792,790	928,742	3,721,532	1,277,664	15,507,268	2,443,868
1938	2,243,571	810,493	3,054,064	1,213,186	17,348,146	1,840,878
1939	2,058,455	340,667	2,399,122	1,264,256	18,483,012	1,134,866
1940	1,607,012	286,338	1,893,350	1,351,847	19,024,515	541,503
1941	1,538,989	429,974	1,968,963	1,404,182	19,589,296	564,781
1942	1,618,925	260,051	1,878,976	1,385,479	20,082,793	493,497
1943	1,202,368	282,418	1,484,786	1,503,427	20,064,152	(—)18,641
1944	1,556,192	511,308	2,067,500	1,678,421	20,453,231	389,079
1945	1,690,315	419,984	2,110,299	1,736,717	20,826,813	373,582

at which these reserves can be produced with or without physical waste.

For comparative purposes a summary tabulation of the overall figures contained in the committee's annual reports covering the period from 1937 to 1945, inclusive, is printed above.

The committee which prepared the report was as follows:

J. Edgar Pew (chairman), Sun Oil Co., Philadelphia; R. F. Baker, The Texas Co., New York; L. T. Barrow, Humble Oil & Refining Co., Houston; D. V. Carter, Magnolia Petroleum Co., Dallas; Frank R. Clark, Ohio Oil Co., Tulsa; Alexander Deussen, consulting geologist, Houston; G. Clark Gester, Standard Oil Co. of California, San Francisco; F. H. Lahee, Sun Oil Co., Dallas; J. M. Sands, Phillips Petroleum Co., Bartlesville, Okla.; Fred Van Covern, API, New York; Theron Wasson, Pure Oil Co., Chicago; Robert T. Wilson, La Gloria Corp., Corpus Christi, Tex.; Fred E. Wood, Standard Oil Co. (Indiana), Chicago.

Plan to Expedite Evaluation Of Oil Reservoir Revealed

Special to NPN

MT. VERNON, Ill.—A plan to expedite simply and inexpensively evaluation of petroleum reservoir behavior was revealed here last week by Alec Crowell, consulting petroleum engineer of Jackson, Miss., in an address before a joint meeting of Illinois Society of Petroleum Engineers and Illinois Basin Chapter of API.

Mr. Crowell said, "At an average cost of $4.75 per well per month, an engineering co-operative representing 75% of the wells and 68% of the production of oil and gas in Mississippi has brought about an understanding, not only between operators but between state and operator, that is unique in the history of the petroleum industry.

"Continuous pool studies reflecting the complete physical aspects of each oil and gas reservoir of Mississippi make possible an evaluation of economic conditions that is always current. Co-operative service has lightened the burden of the technical staffs of its operator-members with resulting economics."

Mr. Crowell said the Mississippi Committee, unlike the first co-operative formed some 20 years ago, is confined to a geological, statistical and factual-engineering program.

As a result of the committee's work, conservation of oil and gas, rapid acceptance and assimilation of good operating practice and systems is being brought about at a cost of only 1/5c per bbl. of oil and condensate produced, the speaker declared.

Lease Extension Payments

WASHINGTON — General Land Office reminded lease-holders last week that no five-year oil and gas lease expiring prior to Dec. 31, 1946, will be considered as extended to that date, under recent extension law passed by Congress (Public 231, 79th Congress), until rentals are paid to and including last date of the extension period.

Oklahoma, Kansas Allowables

OKLAHOMA CITY—Oklahoma March crude allowable has been set at 359,525 b/d by State Corporation Commission, a cut of nearly 30,000 b/d from February figure. Allowable, "lowest in at least a year," follows recommendation of Bureau of Mines, according to commission spokesman. Opposition to the heavy cutback was made by most of the major companies.

° ° °

WICHITA, Kans.—Kansas Corporation Commission has set total crude allowable for March at 250,000 b/d with 4800 bbl. of that figure for petroleum liquids other than crude. March figure is 4200 bbl. under February allowable and is lowest since Sept. 1941 when allowable was set at 248,800 b/d. There were no protests, commission official said.

California Crude Output Rises

LOS ANGELES — California crude oil production for 1945 was 326,481,630 bbls., an increase of 14,688,294 over 1944 production. Daily average for the year was 894,470 compared with 851,394 for the previous year, an increase of 42,576 b/d. Figures are from American Petroleum Institute.

Montana Crude Output Drops

GREAT FALLS, Mont.—Crude oil production in Montana during 1945 was 8,420,450 bbls. according to a report by the state conservation board. This is 226,014 bbls. less than was produced in 1944.

IPAA Head Outlines Program To Aid Producing Industry

Special to NPN

WICHITA FALLS, Tex.—A four-point program as a prerequisite to a healthy and solvent producing industry was outlined here this week by Maj. B. A. Hardey, president, Independent Petroleum Assn. of America, in an address before North Texas Oil and Gas Assn.

Maj. Hardey asserted that adoption of the whole program is necessary if the producing branch of the oil industry is to remain in business. The program as outlined calls for:

1. Immediate removal of price restrictions and controls by OPA.

2. A national oil policy on importation of cheap crude oil produced in foreign countries should be adopted by Congress and imports should be restricted to the point where they will not stagnate the domestic industry which is already burdened with high production costs.

3. Different oil producing states through their regulatory bodies should maintain production quotas that are not in excess of consumptive demand. Any production above market requirements induces physical and economic waste.

4. Continuation of an equitable tax policy by Congress recognizing the hazards peculiar to the business of finding and producing petroleum is also essential.

Seek Exploration Funds

WASHINGTON — Request for funds with which to commence initial work on exploration of Continental Shelf is being submitted to Budget Bureau by Interior Department. Amount being asked was not disclosed, but if appropriated by Congress entire sum will go to U. S. Geological Survey for expenditure during fiscal year starting July 1, although Bureau of Mines also had sought to participate in early, as well as some later, phases of project.

Michigan Crude Runs Rise

LANSING, Mich.—January crude oil runs in Michigan totaled 1,404,011 bbls., or a daily average of 45,290 bbls. This is a 2% increase over December when crude runs were 1,371,572 bbls. with a daily average of 44,244 bbls.

Engineers' Institute Told of Need for Greater Exploration for New Oil Reserves

NPN News Bureau

CHICAGO — The present petroleum outlook indicates a necessity for greater exploration to locate new domestic underground oil reserves, new pipelines and increased capacity of present lines in South America and the Middle East, and future increased imports of heavy fuel oil to supplement the domestic supply.

These views were expressed in reports by the petroleum group of the American Institute of Mining and Metallurgical Engineers convention during its four-day session here in Palmer House Feb. 25-28.

To aid domestic problem of future increases in production, Gordon H. Fisher, petroleum engineer, Gulf Oil Corp., declared that a price increase for crude is needed for Texas oil men to encourage research and meet higher drilling costs due to size of wells and increase in depths of deposits.

"Although West Texas in 1945 produced 175,500,000 bbls. of crude oil and 1944 production was 159,900,000 bbls.," he said "new reserves are diminishing each year. . . . . Considerable attention has been given to locating new reserves in West Texas but out of 222 wildcat wells drilled in 1945, 209 wells, or 82.5%, were completed as dry holes."

P. B. Leavenworth, Gulf Oil Corp., said wildcat drilling in 1945 discovered 23 new fields in the upper Gulf Coast area at depths from 2000-10,000 ft. In the South Texas area, comprising 26 counties, 46 new fields were discovered in 1945 as against 54 in 1944, although the number of wildcat wells drilled during the two years was about equal, he reported.

L. E. Porter, Richfield Oil Corp., told the session 19% of total U. S. crude was produced in California in 1945, but wartime crude shortage was so acute that it was augmented by tank car imports from Texas and Rocky Mountain fields. These imports, he said, reached a high of 64,800 b/d in June, 1945. Total domestic imports for the state for the first eleven months were 12½ million barrels. California now has 71 wells below 12,000 ft. level representing 32% of all such wells in the U. S., he stated. Failure to locate new reserves in California has led companies to extend operations to Pacific Northwest and Mexico, he reported.

Three Difficulties Cited

Three basic difficulties—transportation problems, need for more pipelines, and foreign laws unfavorable to American exploitation—must be overcome before foreign production can be increased, oil men were told.

J. Terry Duce, director and vice president, Arabian American Oil Co., in his report stated that production in Arabia and Bahrein is being retarded because of limitations imposed by present pipeline capacity. Pipelines are now under construction from Dhahran to Abqaiq and from Dhahran to Ras Tanura. No new wells were completed in 1945, because of the necessity of opening and reconditioning of wells that had been "cemented in" as a precautionary measure during the war.

His report indicated that crude throughput at the newly completed refinery at Ras Tanura is expected to exceed 60,000 b/d when in full operation. First unit of the refinery went on stream last September and the second unit in December. The report added that 100-oct. gasoline was produced last June when a refinery extension had been completed and crude from Arabia was piped across Gulf of Selwa. Arabian crude, he said, is now being delivered direct to Awali plant of Bahrein Petroleum Co., Ltd.

Citing problems faced in South American operations, O. C. Wheeler, chief geologist, International Petroleum Co., Ltd., said two were outstanding—distance from markets and laws hindering American operations. He pointed out that in Colombia 24 geological and 14 seismograph parties have conducted researches and this year could see a lot of exploratory drilling if laws were more favorable to outside capital.

"In 1945 Colombia awarded contracts on six tracts of land—two to Tropical and one each to Socony-Vacuum, Richmond, Texas Co. and Gulf. No drilling has been done by these companies under present laws," he explained.

Results of drilling in Canadian fields have been disappointing, according to G. S. Hume, geologist for Oil Controller, but added that wildcat wells have brought some encouragement for future development. Canadian production for '45 was off 1½ million bbls. (35 Imperial gals. per barrel) from that of '44.

Offsetting Production Drop

Any possible decline in U. S. crude production within the next 10-20 years can be offset through feasible economic means, J. D. Gill, economist, told the session.

"The United States can meet increased requirements for gasoline through hydrocarbon synthesis and technical advancement in refinery operations," he said. "As pressure increases for advanced catalytic equipment, there will be a reduction in residual fuels which can be met by low-priced imports."

Howard W. Page, economics department, Standard Oil Co. (New Jersey), discussing trends in foreign and domestic petroleum operations said that a pronounced decline was expected shortly after the war but in the six-month period following V-J Day foreign crude oil production and refinery operations have increased. However, he asserted U. S. exports of refined products will continue and the subsequent drop in residual fuel oil at home will be balanced through imports as foreign production is in excess of demand.

Increased domestic requirements 10 to 20 years from now will be met by a combination of the following methods: (1) crude, natural gasoline and condensate production at maximum efficient rates; (2) further expansion of hydrocarbon synthesis process; (3) further reduction of residual fuel oil yields to produce more light products from crude with increased residual imports to balance; (4) increased crude imports.

German Data Helps Speed Up Synthetic Fuels Research

NPN News Bureau

CHICAGO — German progress and know-how in the production of synthetic liquid fuels are being applied in this country to speed up our own research and development in this field, according to Dr. W. C. Schroeder, chief of the Bureau of Mines' Office of Synthetic Liquid Fuels.

Speaking here Feb. 27 before the Coal Division at the annual meeting of the American Institute of Mining and Metallurgical Engineers, Dr. Schroeder told how information and data obtained by the teams of U. S. and British scientists which followed the advancing Allied armies into Germany, is being utilized in this country.

"As a result of German research work we now have a fairly comprehensive picture of what can be done with the Fischer-Tropsch process," he stated, adding that:

"We now know much more about catalysts for the reaction, including some which will increase yields two or three times over what we have been able to obtain with our own catalysts."

Regarding the coal hydrogenation process, which was used extensively in Germany for making aviation gasoline, Dr. Schroeder said that we have learned how Germans stepped up yields by increasing reaction temperatures. In both our own and British experiments with higher temperatures, according to Dr. Schroeder, an excessive amount of coke quickly formed and plugged the reactors, a difficulty which the Germans overcame.

Also on the program and speaking on German synthetic liquid fuels was Dr. A. R. Powell, Koppers Co., who with Dr. Schroeder, was on the Technical Oil Mission to Germany.

Texas Proration Hearing Set

Special to NPN

AUSTIN—Texas Railroad Commission has scheduled the next statewide proration hearing here for March 15. Evidence will be taken upon which to base the commission's April oil order.

Abundant Production Only Inflation Cure, Pew Says

NPN News Bureau

PHILADELPHIA—Abundant production of civilian necessities is the only cure for inflation.

This statement was made last week by J. Howard Pew, president, Sun Oil Co., who, at the same time, charged that OPA controls are strangling American industry in its efforts to produce these commodities. Extension of OPA for another 16 months, now being urged upon Congress, will bring about more shortages, resulting in additional stopgap federal controls, all "with disastrous results to American living standards," he asserted.

Mr. Pew's statement was made in conjunction with an announcement that Sun Oil established new records in crude production and runs to refinery stills in 1945. He told stockholders in his annual report that proved crude reserves were increased to a new high of 615,000,000 bbls. Operations in other departments of the company, however, were below 1944.

Survey To Determine Public's Attitude Toward Oil Industry

NPN News Bureau

NEW YORK — An intensive survey of a cross-section of the American public, designed to determine the general attitude toward the petroleum industry and its performance will be started this week, under the direction of Opinion Research Corp., operating in behalf of API, under a resolution adopted at institute's last convention.

Subcommittee on surveys, of Public Relations Advisory Committee of API, last week completed its tentative questionnaire, after several exploratory pilot tests had been made. About 10,000 persons will be interrogated and average interview, which may provide a guidepost for future industry policies, will require a half hour. Ralph Champlin of Ethyl Corp., who is chairman of the subcommittee, said first report of the survey is expected in May but that final report will require a much longer period. He added that until a report is made to the API board of directors it cannot be made public.

Favors U. S. Concessions

NPN News Bureau

WASHINGTON—Saudi Arabia's first minister to the U. S. Asad Al Faqih, has expressed approval of the way American oil companies have conducted operations in his country.

Arabia's oil policy, he said, is to "develop for the benefit of the country and for those interested in buying it." While no further concessions are planned for the near future, he said Saudi Arabia would take into consideration what companies should get concessions, if oil is discovered in other parts of the country.

"The concessions ought to go to American companies, though," the minister opined, pointing out that his government was not making any difference between nations, and may try others in the future, but was pleased with the manner in which Americans had done business there.

Possibility of Soviet Russia getting any concessions appeared extremely remote, however, in view of the minister's further statement that his country did not have any diplomatic relations with them at the present time and no plans for establishing any.

Heads Reorganized Company

NPN News Bureau

TULSA—Officers selected to head the recently reorganized Nebraska Producing and Refining Co. now known as Oil Marketing and Refining, Inc., are: John Peters, Salem, Neb., president and treasurer; J. R. Watt, Tulsa Iron and Metal Co., Tulsa, vice president; and Katheryn Peters, Salem, secretary. Board of directors includes the officers and Meyer Moran, Moran Oil Co., Tulsa, and A. M. Stekoll, Tulsa Supply Co., Tulsa.

Assets of Nebraska company, purchased jointly by the four men, include the 4500 b/d skimming plant at Salem, fleet of trucks, company's marketing facilities, and producing properties which are in the Falls City and Dawson pools of Richardson county, Neb. Production from company's wells is now averaging 110 b/d and drilling campaign will begin soon, Mr. Watt said. Consideration was not disclosed.

District Jobbers Meet Set

MADISON — Wisconsin Petroleum Assn. will hold the first of a series of local meetings at the Beaumont Hotel, Greenbay, March 12, according to Ken. C. King, executive secretary. Purpose of the meeting is to organize jobber groups or committees on a district basis throughout the state for closer contact on local problems. Both members and non-members of the association are being invited.

Canada Lifts Butyl Restrictions

Special to NPN

OTTAWA—Effective March 1, all rubber control restrictions on purchase and use of butyl synthetic rubber in Canada were lifted. Anyone may now buy butyl and use it as he sees fit, subject only to price control which will continue under the Wartime Prices and Trade Board.

Rubinstein Trial Set March 21

NEW YORK — Serge M. Rubinstein, chairman of the board of Panhandle Producing & Refining Co., will be brought to trial in Federal Court here March 21, on charges of violating the Selective Service Act. Mr. Rubinstein, who has pleaded not guilty, is free on $20,000 bail.

Market Reports

MIDWESTERN — Three midwestern refiners lowered their prices 0.1 to 0.125c per gal. on 78-80 oct. Ethyl and 73-75 oct. (regular) gasoline the past week, but did not meet the lows quoted by other refiners for these two grades.

Brisk demand for light and heavy burning oils kept quotations of refiners and tank car marketers firm at ceilings. Acute shortage of kerosine and range oil continued and refiners said that, even if warm weather eased demand, it would be some time before they felt any slack because of being so far behind on orders.

Two marketers reported increases in their Group 3 prices for gasoline, while one lowered his price 0.25c on Ethyl. Marketer who had been quoting 4.5 to 5c for 73-75 oct. boosted his price to 4.75 to 5c, while another marketer who had raised his price for this grade 0.125c to 4.625c the third week in February said he was now asking 4.625 to 4.75c. "Some refiners are up to 4.625c, F.O.B. Group 3, in their quotations to me," he said. Same marketer said he anticipated advancing Ethyl price.

Refiner, noting rise in marketers' quotations, expressed belief that prices may hold at present levels among refiners until spring demand from farmers and filling of bulk plants around the Great Lakes drains off the surplus in this area.

At the end of the week Group 3 gasoline quotations reported by refiners ranged from 5.75 to 6.75c for 78-80 oct. Ethyl, and 5 to 6c for 73-75 oct. regular; marketers' quotations for these grades range from 5.125 to 5.75c and 4.375 to 5.125c, respectively.

MIDCONTINENT — Gasoline demand in Kansas showed a decided increase the past week due to jobbers filling storage before the one-cent increase in motor fuel tax went into effect March 1. Elsewhere in the Midcontinent, gasoline remained slow. Of refiners contacted the past week, more than half said they had cut crude runs from 10 to 50% since end of the war, due mainly to lack of market for gasoline.

Low of price range for 78-80 oct. Ethyl in Kansas was down 0.05c to 6.7c when refiner formerly quoting 7.3c reported lowering his price. Price ranges on other refined products remained unchanged throughout the Midcontinent.

Grade 26-70 natural gasoline was quoted at 2.25 to 2.5c F.O.B. Breckenridge with no open spot sales reported during the week. Sellers quoted 2.75 to 3c, F.O.B. Group 3, and open spot sales of two cars at 2.75c were reported Feb. 25 and 28; one car was reported sold open spot at that price, March 1.

Spring demand for kerosine for use in brooders and incubators has set in, according to several Midcontinent refiners. Added demand is expected to keep the product in short supply for several weeks.

WESTERN PENNA. — Continued heavy demand for all products, except gasoline, was reported by western Penna. refiners the past week. Prices generally were unchanged.

In the Bradford-Warren district, one refiner reduced his quotation for 74 oct. gasoline 0.5c to 7.25c per gal., but aside from this, prices for all products were firm. One other Bradford-Warren district refiner offered 74 oct. at 7c. Gasoline was plentiful in both the upper and lower districts.

While supplies of kerosine and light fuel oils were still relatively tight, more material was available than for some time past, particularly in the lower field.

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ATLANTIC COAST — Signs of easing in kerosine and light fuel oils appeared in markets along the Atlantic Seaboard while gasoline continued weak in the week ended March 2. Gasoline prices were off 0.2 to 0.5c per gal. in some districts.

Burning oils were far from what could be called freely available. But, as one buyer put it, "you don't have to take as much gasoline to get kerosine and the light fuels as you did two weeks ago." This buyer also said he was able to get "loans" from some suppliers from whom he had been unable to make out-and-out purchases.

Heavy fuels remained firm, according to reports, due to the combined heavy demand from industrial accounts and ships for bunkers.

Sharpest cut in gasoline prices the past week was at Baltimore where one supplier dropped his quotations 0.5c per gal. to 6.5c for regular-grade, 7.5c for premium. Octane ratings were 76-78, and 80-83, for the two grades, respectively, he said.

"We find a leading Baltimore supplier discounting his 7c per gal. price by 0.5c for the 76-78 grade," the supplier who reduced his quotations said, and "accordingly we are reducing our posted prices for both grades."

Tank car quotations reported by other Baltimore suppliers ranged up to 7.45c for regular, 8.7c for premium.

Reduction of 0.2 to 0.3c in tank car postings for regular-grade also were reported at several other points, but, for the most part, only the highs of price ranges at Albany, Mobile, New Orleans, and Providence were affected.

* * *

GULF COAST — Prices generally were unchanged at the Gulf the past week, according to reports in New York and from the Southwest. Gasoline continued to be freely offered. Other products were steady to firm.

Reports of price shading on gasoline persisted throughout the week, but as far as could be ascertained, no open spot sales or firm offers were made below 5.25c per gal. for regular-grade.

"We'd have no trouble in doing 5c on regular-grade if we were interested in taking in more material at this time," one large buyer commented, "but our tanks are full now."

Several inquiries for gasoline were said to be in the market but most observers described them as merely "market feelers."

"Any number of buyers are in the market for No. 2 fuel and residuals," said one trader, "but to get these oils, they'd have to take some gasoline and their gasoline tanks already are almost overflowing."

Reduction in Texas crude allowable for March was seen by some observers as a hopeful sign. "This may seem the downward trend of gasoline at the Gulf," one source commented, "but at the same time there's still a big inventory down there." Inventories at Texas Gulf Coast plants on Feb. 23 as reported by American Petroleum Institute totaled more than 16 million bbls. At this level, however, stocks were off more than one million bbls. from Feb. 16.

* * *

CALIFORNIA — After long dullness, a lively interest in gasoline for export from Pacific ports was evident in the last week. Companies reported inquiries from brokers and one sales executive said he believed these did not relate to domestic market.

At same time, some easing of domestic gasoline prices was reported in Southern California. Sales said to have been made at under 7c for regular grade, 8c for premium, but these lacked confirmation and no quotations were reported under these prices.

Standard Oil Co. of California reported its third grade gasoline entirely withdrawn from service stations. Formerly marketed under brand name "Flight", only insignificant amount of third-grade gasoline is being made for uses where unleaded fuel is required, a company spokesman said.

Summary of Daily Gasoline Prices (February 25 to March 4)

	Monday March 4	Friday March 1	Thursday Feb. 28	Wednesday Feb. 27	Tuesday Feb. 26
U. S. Motor (ASTM octane)					
78-80 octane Ethyl:					
Oklahoma	5.75 – 6.75	5.75 – 6.75	5.75 – 6.75	5.75 – 6.75	5.75 – 6.75
Mid-Western (Group 3 basis)	5.75 – 6.75	5.75 – 6.75	5.75 – 6.75	5.75 – 6.75	5.75 – 6.75
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
E. Tex. (Truck Tnsp.)	6.5 – 7	6.5 – 7	6.5 – 7	6.5 – 7	6.5 – 7
73-75 octane:					
Oklahoma	5 – 6	5 – 6	5 – 6	5 – 6	5 – 6
Mid-Western (Group 3 basis)	5 – 6	5 – 6	5 – 6	5 – 6	5 – 6
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
E. Tex. (Truck Tnsp.)	5.75 – 6	5.75 – 6	5.75 – 6	5.75 – 6	5.75 – 6
63-66 octane:					
Oklahoma	5.125(1)	5.125(1)	5.125(1)	5.125(1)	5.125(1)
Mid-Western (Group 3 basis)	5.125(1)	5.125(1)	5.125(1)	5.125(1)	5.125(1)
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625(1)	5.625(1)	5.625(1)	5.625(1)	5.625(1)
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625(2)	5.625(2)	5.625(2)	5.625(2)	5.625(2)
E. Tex. (Truck Tnsp.)	....	....	....	....	....
60 octane & below:					
Oklahoma	4.75 – 5.25	4.75 – 5.25	4.75 – 5.25	4.75 – 5.25	4.75 – 5.25
Mid-Western (Group 3 basis)	4.75 – 5.25	4.75 – 5.25	4.75 – 5.25	4.75 – 5.25	4.75 – 5.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
E. Tex. (Truck Tnsp.)	5.25	5.25	5.25	5.25	5.25
U. S. Motor Gasoline (a)					
New York harbor	8 –8.95(2)	8 – 8.95	8 – 8.95	8 –8.95	8 – 8.95
New York harbor, barges	7.9(1)	7.9 (2)	7.9(2)	7.9(2)	7.9(2)
Philadelphia district	8 – 8.95	8 –8.95	8 – 8.95	8 – 8.95	8 – 8.95
Philadelphia, barges	....	....	....	....	....
Baltimore district	7.5 – 8.7	7.5 – 8.7	7.5 – 8.7	8 – 8.7	8 – 8.7
Baltimore, barges	....	....	....	....	....
Motor Gasoline (b)					
New York harbor	7 – 8	7 – 8	7 – 8	7 – 8	7 – 8
New York harbor, barges	6.9 – 7.6	6.9 – 7.6	6.9 – 7.6	6.9 – 7.6	6.9 – 7.6
Philadelphia district	7 – 8	7 – 8	7 – 8	7 – 8	7
Philadelphia, barges	6.9(1)	....	....	....	....
Baltimore district	6.5 – 7.45	6.5 – 7.45	6.5 – 7.45	7 – 7.45	7 – 7.45
Baltimore, barges	6.9(1)	....	....	....	....
Motor Gasoline:					
Western Penna. Bradford-Warren:					
74 Oct.	7 –7.25(2)	7 –7.25(2)	7 –7.25(2)	7 –7.25(2)	7-7.25(2)
Western Penna. Other Districts:					
74 Oct.	6.75 – 7.25	6.75 – 7.25	6.75 – 7.25	6.75 – 7.25	9.75 – 7.25

Note: Gasoline prices are as reported in each day's Platt's OILGRAM Daily Oil Price Service.
(a) 80-83 oct. (Ethyl) for March 4; 78-80 oct. for Feb. 25 to March 1, inclusive.
(b) 76-79 oct. for March 4; 73-75 oct. for Feb. 25 to March 1, inclusive.

OIL PRICE SECTION ★ At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from Platt's *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all *NPN-OILGRAM* offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

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Refinery Prices

Gasoline —U. S. Motor (ASTM octane except where otherwise specified)

Prices in Effect	Mar. 4	Feb. 25
OKLAHOMA		
78-80 oct. Ethyl	5.75 – 6.75	5.75– 6.75
73-75 oct.	5 – 6	5 – 6
63-66 oct.	5.125(1)	5.125(1)
60 oct. & below	4.75 – 5.25	4.75 – 5.25
MID-WESTERN (Group 3 basis)		
78-80 oct. Ethyl	5.75 – 6.75	5.75 – 6.75
73-75 oct.	5 – 6	5 – 6
63-66 oct.	5.125(1)	5.125(1)
60 oct. & below	4.75 – 5.25	4.75 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78-80 oct. Ethyl	7	7
73-75 oct.	6	6
63-66 oct.	5.625(1)	5.625(1)
60 oct. & below	5.2 – 5.25	5.2 – 5.25
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78-80 oct. Ethyl	7	7
73-75 oct.	6	6
63-66 oct.	5.625(2)	5.625(2)
60 oct. & below	5.25	5.25
E. TEX. (Truck Tnspt.)		
78-80 oct.	6.5 – 7	6.5 – 7
73-75 oct.	5.75 – 6	5.75 – 6
60 oct. & below	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
78-80 oct.	7 (2)	7 (2)
73-75 oct.	6 (2)	6 (2)
60 oct. & below	5.25 (2)	5.25(2)
KANSAS (For Kansas destinations only)		
78-80 oct. Ethyl	6.7 – 7.3	6.75 – 7.3
63-66 oct.	5.75 – 6.3	5.75 – 6.3
63-66 oct.	5.5 – 5.9(2)	5.5–5.9(2)
60 oct. & below	5 – 5.5	5 – 5.5
ARK. (For shipment to Ark. & La.)		
78-80 oct. Ethyl	6.625(1)	6.625(1)
73-75 oct.	5.625(1)	5.625(1)
60 oct. & below unleaded	5 (1)	5 (1)
WESTERN PENNA.		
Bradford-Warren:		
74 oct.	7 –7.25(2)	7 –7.25(2)
Other districts:		
74 oct.	6.75 – 7.25	6.75 – 7.25
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis; for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
U.S. Motor:		
73-75 oct.	7 –8.25	7 –8.25
78-80 oct.	8 –9.25	8 –9.25
Str. run gasoline, excluding Detroit shpt.	5 – 6	5 – 6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances.)		
73-75 oct.	8	8
CALIFORNIA		
80-82 oct. (Ethyl)	8 – 8.5	8 – 8.5
74-75 oct.	7 – 7.5	7 – 7.5

Kerosine, & Gas Fuel Oils———

Prices in Effect	Mar. 4	Feb. 25
OKLAHOMA		
41-43 grav. w.w.	4.875	4.875
42-44 grav. w.w.	5	5
Range Oil	4.5	4.5
No. 1 p.w.	4.375	4.375
No. 1 straw	4.25 (1)	4.25 (1)
No. 2 straw	4.125	4.125
No. 3 fuel	4	4
No. 6 fuel	$0.90-$0.97	$0.90-$0.97
14-16 fuel	$0.97 (1)	$0.97 (1)
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w.	4.8 – 4.875	4.8 – 4.875
41-44 grav. w.w.	5	5
Range Oil	4.5	4.5
No. 1 p.w.	4.375	4.375
No. 2 straw	4.125	4.125
No. 3	4	4
No. 6	$0.90-$0.97(2)	$0.90-$0.97(2)
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w.	4.875	4.875
42-44 grav. w.w.	5 (1)	5 (1)
No. 1 p.w.	4.375(1)	4.375(1)
No. 6 fuel	$0.97 (1)	$0.97 (1)
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
No. 6 fuel	$0.97(1)	$0.97(1)
E. TEX. (Truck trnspt.)		
41-43 grav. w.w.	4.875	4.875
Tractor fuel	4.875– 5	4.875– 5
Range oil	4.5 (1)	4.5 (1)
No. 1 p.w.	4.375(1)	4.375(1)
45 Cet. Diesel	4.75 (1)	4.75 (1)
No. 2 straw	4 –4.125(2)	4 –4.125(2)
58 D.I. & above	4.75 (1)	4.75 (1)
No. 6 fuel	$0.97	$0.97
U.G.I. gas oil	3.5 (1)	3.5 (1)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
42-44 grav. w.w.	5 (1)	5 (1)
KANSAS (For Kansas destinations only).		
42-44 grav. w.w.	5.2	5.2
No. 1 p.w.	4.6	4.6
No. 6 fuel	$1.02	$1.02
ARK. (For shipment to Ark. and La.)		
42-44 w.w. kero	5 (1)	5 (1)
No. 2	4.125(1)	4.125(1)
No. 3 fuel	4 (1)	4 (1)
Tractor fuel	5.125(1)	5.125(1)
Diesel fuel 52 & below	4.5 (1)	4.5 (1)
Diesel fuel 58 & above	4.75 (1)	4.75 (1)
WESTERN PENNA.		
Bradford-Warren:		
45 grav. w.w.	6.55 – 7.05	6.55 – 7.05
No. 2 "	6.75(1)	6.75(1)
No. 3 "	6.75(1)	6.75(1)
36-40 gravity	6.25(2)	6.25(2)
Other districts:		
45 grav. w.w.	6.925	6.925
47 grav. w.w.	7.05(2)	7.05(2)
No. 1 fuel	6.675–6.925	6.675–6.925
No. 2 "	6.25 – 6.375	6.25 – 6.375
No. 3 "	6.25 – 6.375	6.25 – 6.375
36-40 grav.	5.75 – 6.375	5.75 – 6.375
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
44-46 kerosine	6.25(1)	6.25(1)
46-49 gravity w.w.	6.3 – 6.5	6.3 – 6.5
P.W. Distillate	6	6
No. 2 light straw	5.75 (1)	5.75 (1)
No. 3 gas oil, Straw	5.5	5.5
U.G.I. gas oil	5	5
Fuel Oils (*Vis. at* 100).		
300-500 Vis.	4.14	4.14
100-300 Vis.	4.375– 4.5	4.375– 4.5
OHIO (S. O. Ohio quotations for statewide delivery)		
Kerosine	7.5	7.5
CALIFORNIA		
40-43 grav. w.w.	.....	7 (1)
San Joaquin Valley:		
Heavy fuel	$1.10 (2)	$1.10 (2)
Light fuel	$1.20 (1)	$1.20 (1)
Diesel fuel	4.75 (2)	4 (2)
Stove dist.	5.75 (2)	5 (2)
Los Angeles:		
Heavy fuel	$1.10 (2)	$1.10 (2)
Light fuel	$1.20 (1)	$1.20 (1)
Diesel fuel	4 – 4.75	3.25 – 4 (2)
Stove dist.	5.75 (2)	5 (1)
San Francisco:		
Heavy fuel	$1.15 (2)	$1.15 (1)
Light fuel	$1.25 (2)	$1.25 (1)
Diesel fuel	5.25 (2)	4.5 (1)
Stove dist.	6.25 (2)	5.5 (1)

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

Lubricating Oils

Prices in Effect	Mar. 4	Feb. 25
WESTERN PENNA.		

Prices are for sales made, or offers reliably reported, to jobbers & compounders only.

Viscous Neutrals—*No. 3 col. Vis. at* 70°*F.*

200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.	38 (1)	38 (1)
10 p.t.	37 (1)	37 (1)
15 p.t.	36 (1)	36 (1)
25 p.t.	28–33	28–33
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.	36 (1)	36 (1)
10 p.t.	35 (1)	35 (1)
15 p.t.	34 (1)	34 (1)
25 p.t.	26–31	26–31

NOTE: Limited quantity neutrals available to regular trade.

Cylinder Stocks:

Brt. stk., 145-155 *vis. at* 210°, 540-550 fl., *No. 3 col.*

10 p.t.	30.5 (1)	30.5 (1)
15 p.t.	29.5 (1)	29.5 (1)
25 p.t.	25	25
600 S.R. filterable	15	15
650 S.R.	15.5	15.5
600 fl	16	16
630 fl	17	17
MID-CONTINENT (F. o. b. Tulsa)		
Neutral Oils (*Vis. at* 100° *F. to* 10 *P.P.*)		
Pale Oils:		
Vis. Color		
60-85—No. 2	7.5	7.5
86-110—No. 2	7.5 (2)	7.5(2)
150—No. 3	11 –11.5	11 –11.5
180—No. 3	11.5–15	11.5–15
200—No. 3	12 –15	12 –15
250—No. 3	14 –16.5	14 –16.5
280—No. 3	15	15
300—No. 3	16 (2)	16 (2)
Red Oils:		
180—No. 5	11.5 (1)	11.5 (1)
200—No. 5	12 (1)	12 (1)
300—No. 5	16 –17.5(2)	16 –17.5 (2)
Bright Stock—*Vis. at* 210°		
200 Vis. D	27 (1)	27 (1)
150-160 Vis. D:		
0 to 10 p.p.	23	23
10 to 25 p.p.	22.5–23	22.5–23
25 to 40 p.p.	23 (1)	23 (1)
150-160 Vis. E	22 (1)	22 (1)
120 Vis. D:		
0 to 10 p.p.	22 (2)	22 (2)
600 S.R. Dark Green	8.5 (1)	8.5 (1)
600 S.R. Olive Green	10-11(2)	10-11 (2)
SOUTH TEXAS (Neutral Oils)		
Pale Oils (*Vis. at* 100° *F.*)		
Vis. Color		
100 No. 1½-2½	6.5	6.5
200 No. 2-3	8.75	8.75
300 No. 2-3	9.25	9.25
500 No. 2½-3½	10	10
750 No. 3-4	10.25	10.25
1200 No. 3-4	10.375	10.375
2000 No. 4	10.5	10.5

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

Refinery Prices—Continued

Prices in Effect	Mar. 4	Feb. 25
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-5	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10.375	10.375
2000 No. 5-6	10.5	10.5

CHICAGO (From Mid-Continent p.l. crude). Neutral oils *vis. at* 100° *F.* 0 *to* 10 *p.p.*

Pale Oils:		
Vis Color		
60-85—No. 2	9 (1)	9 (1)
86-100—No. 2	9.25(1)	9.25(1)
150—No. 3	12.5(1)	12.5(1)
180—No. 3	13(1)	13(1)
200—No. 3	13(1)	13(1)
250—No. 3	14(1)	14(1)
Red Oils:		
180—No. 5	13(1)	13(1)
200—No. 5	13(1)	13(1)
250—No. 5	14(1)	14(1)
280—No. 5	15(1)	15(1)
300—No. 5	15.5(1)	15.5(1)

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

Unfiltered Steam Refined (*Viscosity at* 210°)		
140	11.5(1)	11.5(1)
160	12.5(1)	12.5(1)
200	13.5(1)	13.5(1)
Bright stocks, 160 *vis. at* 210 *No.* 8 *color:*		
0 to 10 p.p.	24(1)	24(1)
15 to 25 p.p.	23.5(1)	23.5(1)
30 to 40 p.p.	21.5(1)	21.5(1)
E filtered Cyl. Stock	15.5(1)	15.5(1)

Note: To obtain prices delivered in Chicago add 0.25c per gal.

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3		
Grade 26-70	2.75 (Sales)	2.75 (Sales)
FOB BRECKENRIDGE		
Grade 26-70	2.25 (Quotes)	2.25-2.5 (Quotes)

CALIFORNIA (FOB plants in Los Angeles basin)

21-21.9 pound vapor pressure for blending	4.71–4.85(1)	4.75(1)

Naphtha and Solvent

(*FOB Group* 3)		
Stoddard solvent	6.5 – 6.625	6.5 –6.625
Cleaners' naphtha.	7.125	7.125
V.M.&P. naphtha.	7.1 –7.125	7.1 – 7.125
Mineral spirits	6.1 – 6.125	6.1 – 6.125
Rubber solvent	7.1 – 7.125	7.1 – 7.125
Lacquer diluent	7.375– 8.125	7.375– 8.125
Benzol Diluent	7.875– 8.625	7.875– 8.625
WESTERN PENNA.		
Other Districts:		
Untreated naphtha	7 –7.25(2)	7 –7.25(2)
Stoddard solvent	7.25 – 7.5	7.25 – 7.5

OHIO (S. O. quotations for statewide delivery:)

V.M.&P. naphtha.	D.C. naphtha, Sohio solvent	Varnolene & Rubber solvent
9.5	9.5	9

E. TEXAS (Truck Tnspt.)		
Stoddard Solvent	7(2)	7(2)

Wax

WESTERN PENNA. (Bbls. C.L.)

White Crude Scale:		
122-124 A.m.p.	4.25(2)	4.25(2)
124-126 A.m.p.	4.25	4.25

MID-CONTINENT (C.L. FOB Refinery)

Semi-refined:		
132-134 AMP, bbls.	5.25(1)	5.25(1)

CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose, 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

Fully refined:		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars, 0.5c per lb. less.)

Snow White	6.375– 7.25	6.375– 7.25
Lily White	5.375– 6.5	5.375– 6.5
Cream White	4.375– 5.875	4.375– 5.875
Light Amber	3.375– 3.75	3.375– 3.75
Amber	3.125– 3.625	3.125– 3.625
Red	3 – 3.5	3 – 3.5

Tank Wagon Prices

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes**; *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect Mar. 4, 1946 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

ATLANTIC REFINING

	Atlantic White Flash (*Regular Grade*) Commercial T.W.	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Philadelphia, Pa.	8.7	9.2	5.5	11.25
Pittsburgh	9.5	10	5.5	11.6
Allentown	9	9.5	5.5	11.6
Erie	9.5	10	5.5	11.6
Scranton	9.5	10	5.5	11.6
Altoona	9.5	10	5.5	11.6
Emporium	9.5	10	5.5	11.6
Indiana	9.5	10	5.5	11.6
Uniontown	9.5	10	5.5	11.6
Harrisburg	9	9.5	5.5	11.6
Williamsport	9.5	10	5.5	11.6
Dover, Del.	...	9.7	5.5	11.6
Wilmington, Del.	...	9.2	5.5	11.1
Boston, Mass.	...	°9.6	4.5	....
Springfield, Mass.	...	°10.4	4.5	....
Worcester, Mass.	...	°9.8	4.5	....
Fall River, Mass.	...	°9.5	4.5	....
Hartford, Conn.	...	°9.9	4.5	....
New Haven, Conn.	...	°9.5	4.5	....
Providence, R. I.	...	°9.5	4.5	....
Atlantic City, N. J.	...	9.2	4.5	9.0
Camden, N. J.	...	9.2	4.5	9.0
Trenton, N. J.	...	9.2	4.5	9.0
Annapolis, Md.	...	9.55	5.5	9.8
Baltimore, Md.	...	8.95	5.5	8.8
Hagerstown, Md.	...	10.05	5.5	9.3
Richmond, Va.	...	9.5	6.5	11.3
Wilmington, N. C.	...	9.8	7.5	10.9
Brunswick, Ga.	...	9.5	7.5	*10.1
Jacksonville, Fla.	...	9.5	8.5	11.1

°Effective Feb. 19, 1946.

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa.	11	12.5
Lancaster, Pa.	12	13.5
Pittsburgh, Pa.	12.5	13.5

FUEL OILS—T.W.

	1	2	3	5	6
Phila., Pa.	9.1	8.0	8.0	5.15	4.44
Allentown, Pa.	9.6	8.3	8.3	....	....
Wilmington, Del.	9.1	8.0	8.0	....	....
Springfield, Mass.	...	8.4	8.4	....	....
Worcester, Mass.	...	8.4	8.4	....	....
Hartford, Conn.	...	8.2	8.2	....	....

*Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w. except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

CONT'L OIL

	Conoco N-tane (regular) †Tank Wagon	Demand (3rd Grade) Wagon	Gasoline Taxes	Kerosine T.W.
Denver, Col.	10	9	5.5	10
Grand Junc., Col.	12.5	11.5	5.5	12.5
Pueblo, Col.	9.5	8.5	5.5	9.5
Casper, Wyo.	11.5	10.5	5.5	12
Cheyenne, Wyo.	10	9	5.5	9
Billings, Mont.	12	11	6.5	12.5
Butte, Mont.	11.5	10.5	6.5	13.5
Great Falls, Mont.	12	11	6.5	12.5
Helena, Mont.	12	11	6.5	13
Salt Lake City, Utah	13.5	12.5	5.5	14.5
Twin Falls, Ida.	14.5	13.5	7.5	17
Albuquerque, N. M.	10.5	9.5	*7	10
Roswell, N. M.	10	9	*7	7.5
Santa Fe, N. M.	10.5	9.5	*7.5	10.5
Ft. Smith, Ark.	9	6.25	8	8.5
Texarkana, Ark.	9	7.5	*5.5	7.5
Muskogee, Okla.	7.75	6.75	9	8.5
Oklahoma City, Okla.	8	7	9	8.5
Tulsa, Okla.	8	7	9	8.5

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark

†To consumers & Dealers.

HUMBLE OIL

	Humble (*Regular*) *Tank Wagon	Retail	Thriftane (*3rd Grade*) *Tank Wagon	Retail	Gasoline Taxes
Dallas, Tex.	*7.5	10.5	*6.5	8.5	5.5
Ft. Worth, Tex.	*7.5	10.5	*6.5	8.5	5.5
Houston, Tex.	8.5	12.5	7.5	10.5	5.5
San Ant., Tex.	8.5	12.5	7.5	10.5	5.5

*Consumer t.w. prices are 1c per gal. higher than dealer t.w. prices shown above.

	Kerosine *Tank Wagon	Retail
Dallas, Tex.	7.5	10.5
Ft. Worth, Tex.	7.5	11.5
Houston, Tex.	8.5	11.5
San Antonio, Tex.	7.5	10.5

*To all classes of dealers & consumers.

Canada

PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

IMPERIAL OIL

	3-Star Imperial Gasoline (*Regular Grade*) †Gasoline T.W.	*Gasoline Taxes	Kerosine T.W.
Hamilton, Ont.	16.5	11	18
Toronto, Ont.	16.5	11	18
Brandon, Man.	20.5	10	22.5
Winnipeg, Man.	20.0	10	22
Regina, Sask.	17.5	11	19.5
Saskatoon, Sask.	20.3	11	22.3
Edmonton, Alta.	18.4	10	20.4
Calgary, Alta.	15.5	10	17.5
Vancouver, B. C.	15	10	24
Montreal, Que.	16.5	11	17.5
St. John, N. B.	16	13	19
Halifax, N. S.	16	13	19

*Includes 3c Federal, and Provincial taxes.
†To divided & undivided dealers.

SOCONY VACUUM

	Socony Mobilgas (*Regular Grade*) Com. Cons. T.W.	Undiv. Dlr. T.W.	Gasoline Taxes
New York City			
Manhattan & Bronx	8.5	9.0	*5.5
Kings & Queens	8.5	9.0	*5.5
Richmond	8.4	8.9	*5.5
Albany, N. Y.	8.4	8.9	5.5
Binghamton, N. Y.	9.6	10.1	5.5
Buffalo	8.7	9.2	5.5
Jamestown, N. Y.	9.2	9.7	5.5
Mt. Vernon, N. Y.	8.6	9.1	5.5
Plattsburg, N. Y.	9.6	10.1	5.5
Rochester, N. Y.	9.6	10.1	5.5
Syracuse, N. Y.	9.3	9.8	5.5
Bridgeport, Conn.	8.5	9.0	4.5
Danbury, Conn.	9.0	9.5	4.5
Hartford, Conn.	8.9	9.4	4.5
New Haven, Conn.	8.5	9.0	4.5
Bangor, Me.	9.5	10.0	5.5
Portland, Me.	9.0	9.5	5.5
Boston, Mass.	8.6	9.1	4.5
Concord, N. H.	10.0	10.5	5.5
Lancaster, N. H.	10.6	11.1	5.5
Manchester, N. H.	9.7	10.2	5.5
Providence, R. I.	8.5	9.0	4.5
Burlington, Vt.	9.5	10.0	5.5
Rutland, Vt.	9.5	10.0	5.5

	Mineral Spirits T.W.	V.M.&P. T.W.
Buffalo, N. Y.	10.9	12.1
New York City	11	12
Rochester, N. Y.	11.8	13.1
Syracuse, N. Y.	12.2	....
Boston, Mass.	12	13
Bridgeport, Conn.	†16.3	†17.3
Hartford, Conn.	†16.3	†17.3
Providence, R. I.	13	14

	Kerosine Yard	T.W.	Mobilfuel Diesel T.C.	T.W.	Mobilheat Fuel Yard	T.W.
New York City:						
Manhat'n & Bronx	6.5	9.3	...	8.3	6.1	8.0
Kings & Queens	6.5	9.3	...	8.3	6.1	8.0
Richmond	6.5	9.3	...	...	6.1	8.0
Albany	6.5	8.8	5.8	8.3	6.0	8.0
Binghamton	7.9	10.2	...	9.7	7.4	9.2
Buffalo	7.6	9.9	7.0	9.3	7.2	9.0
Jamestown	7.7	10.0	...	9.6	7.3	9.0
Mt. Vernon	6.6	9.3	...	8.4	6.2	8.0
Plattsburg	7.1	9.4	...	8.9	6.6	8.4
Rochester	7.7	10.0	6.9	9.2	6.9	8.7
Syracuse	7.5	9.8	6.8	9.1	6.8	8.6
Conn.:						
Bridgeport	6.8	9.3	...	8.5	6.3	8.0
Danbury	7.2	9.8	...	...	6.8	7.5
Hartford	7.0	9.5	...	8.5	6.4	8.2
New Haven	6.3	9.3	6.0	8.3	5.9	8.0
Maine:						
Bangor	6.9	9.3	6.4	8.7	6.4	8.1
Portland	6.5	9.2	5.8	8.3	6.0	8.0

Tank Wagon Prices—Continued

	Kero-sine	Mobil-fuel Diesel		Mobil-heat Fuel	
	Yard T.W	T.C.	T.W.	Yard T.W.	
Mass.:					
Boston	6.8	9.6	5.8	8.3	6.2 8.1
N. H.:					
Concord	7.4	9.7	...	9.6	7.3 9.1
Lancaster	8.5	10.8	...	10.5	8.2 10.0
Manchester	7.5	10.1	...	9.3	7.0 8.8
R. I.:					
Providence	6.8	9.3	5.8	8.3	6.2 8.1
Vermont:					
Burlington	7.1	9.4	6.5	8.8	6.5 8.2
Rutland	7.3	9.6	...	9.0	6.7 8.5

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).

†In steel barrels.

Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

S. O. CAL.

	Chevron (*Regular*) T.T. Retail	Chev-ron Av. 73 T.T.	Gaso-line Taxes	Kero-sine T.T.
San Francisco, Cal.	10 14	12.5	4.5	°12.25
Los Angeles, Cal.	9.5 13.5	12	4.5	°10.75
Fresno, Cal.	11 15	13.5	4.5	°13.25
Phoenix, Ariz.	12 16	14.5	6.5	°13.25
Reno, Nev.	12 16	14.5	5.5	°14.25
Portland, Ore.	10.5 14.5	13	6.5	°14.25
Seattle, Wash.	10.5 14.5	13	6.5	°14.25
Spokane, Wash.	12.5 16.5	16	6.5	°17.25
Tacoma, Wash.	10.5 14.5	13	6.5	°14.25
Boise, Ida.	13.5 17.5	18	7.5	16.5

Resale and Commercial Gasoline:—Tank car deliveries of Chevron Aviation 73, Chevron Supreme, and Chevron Gasoline .25c per gallon below posted net tank truck price. Pearl Oil (The Standard Kerosine):—Tank car deliveries 3c below posted tank truck price.

°Effective Feb. 20.

S. O. IND.

	Red Crown (Reg. Grade) Blue Crown (3rd Grade) Red Cr'n. Cons. T.W.	Red Cr'n. Dlr. T.W.	Blue Cr'n. Dlr. T.W.	Gaso-line *Taxes	Kero-sine T.W
Chicago, Ill.	11.6	9.6	9.1	4.5	11.1
Decatur, Ill.	11.3	9.6	8.7	4.5	10.8
Joliet, Ill.	11.6	10.1	9.2	4.5	11.1
Peoria, Ill.	11.4	9.9	9.4	4.5	10.9
Indianapolis, Ind.	11.3	9.8	9.3	5.5	10.6
Evansville, Ind.	11.1	9.6	8.6	5.5	10.4
South Bend, Ind.	11.7	10.2	9.7	5.5	11.0
Detroit, Mich.	11.1	9.6	...	4.5	10.5
Grand Rapids, Mich.	11.1	9.6	...	4.5	10.4
Saginaw, Mich.	11.1	9.6	...	4.5	10.4
Green Bay, Wisc.	11.9	10.4	9.9	5.5	11.4
Milwaukee, Wis.	11.8	10.3	9.8	5.5	11.3
La Crosse, Wis.	11.6	10.1	9.6	5.5	11.1
Minneapolis - St. Paul.	11.6	10.1	9.6	5.5	11.1
Duluth, Minn.	11.9	10.4	...	5.5	11.4
Mankato, Minn.	11.6	10.1	9.6	5.5	11.1
Des Moines, Ia.	11.1	9.6	9.1	5.5	10.6
Mason City, Ia.	11.4	9.9	9.4	5.5	10.9
St. Louis, Mo.	11.0	9.5	9.1	4.5	10.6
Kansas City, Mo.	10.7	9.2	8.6	4.5	10.2
St. Joseph, Mo.	10.7	9.2	....	4.5	10.4
Fargo, N. D.	12.6	11.1	10.6	5.5	12.1
Huron, S. D.	12.0	10.5	10.0	5.5	11.5
Wichita, Kans.	9.5	8.6	7.2	°5.5	9.5
Omaha, Neb.	11.1	9.6	9.1	6.5	10.6

Stanavo Ethyl Aviation Number 73

	Cons. T. W.	*Taxes
Detroit, Mich.	15.7	4.5
Fargo, N. D.	15.1	5.5
Huron, S. D.	14.5	5.5
Indianapolis, Ind.	14.2	5.5
Kansas City, Mo.	13.2	4.5

Oleum V.M.&P. Stani-sol *Taxes

(Prices are base prices before discounts)

	Spirits	Naphtha		
Chicago	13.5	13.8	12.8	4.5
Detroit	15.8	15	16.3	4.5
K. C., Mo.	13.3	14.3	13.8	1.5
St. Louis, Mo.	13.7	14.7	13.2	1.5
Milwaukee	14.4	15.4	14.9	5.5
Minneap'lis	14.2	15.2	13.5	5.5

Fuel Oils T.W. Chicago

	Standard Heater Oil	Stanolex Furnace Oil
1-99 gals.	9.8	9.3
100-149 gals.	8.8	8.3
150 gals. & over	8.3	...
150-399 gals.	...	8.3
400 gals. & over	...	7.8

	Stanolex Fuel A	Stanolex Fuel C
1-749 gals.	6.5	5.7
750 gals. & over	5.75	4.95

Stanolex Furnace Oil

Other Points	1-99 gals.	100 gals. & over
Indianapolis	9.5	8.5
Detroit	9.2	8.2
Milwaukee	9.5	8.5
Minneapolis	9.6	8.6
St. Louis	8.9	7.9
Kansas City	8.6	7.6

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 4c state tax. In naphtha tax column are included 1.5c federal tax and state taxes. State sales, occupation, consumer and use taxes to be added where applicable.

°Effective March 1.

S. O. KY.

Crown Gasoline (*Regular*)

	†Crown Net Dealer	Gaso-line Taxes	Kero-sine T.W.
Covington, Ky.	9.5	6.5	$9.8
Lexington, Ky.	10.25	6.5	$9.8
Louisville, Ky.	9.75	6.5	$9.3
Paducah, Ky.	9.75	6.5	$9.3
Jackson, Miss.	**9.5	7.5	*9.6
Vicksburg, Miss.	9.25	7.5	*8.5
Birmingham, Ala.	9.75	*8.5	$9.5
Mobile, Ala.	9	*9.5	$9.0
Montgomery, Ala.	9.75	*9.5	*10.5
Atlanta, Ga.	10.25	7.5	*11.1
Augusta, Ga.	10.25	7.5	*10.6
Macon, Ga.	10.25	7.5	*10.6
Savannah, Ga.	9.5	7.5	*10.1
Jacksonville, Fla.	9.5	8.5	$9.1
Miami, Fla.	9.5	8.5	$9.1
Pensacola, Fla.	9	*9.5	$8.5
Tampa, Fla.	9.5	8.5	$9.1

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city, Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, included in above prices.

†Consumer t.w. prices are same as net dealer prices.

**Correct price for Feb. 12 was 9.75.

S. O. N. J.

Esso (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gaso-line Taxes	Kero-sine T.W.
Atlantic City, N. J.	8.70	9.20	4.5	9.0
Newark	8.70	9.20	4.5	9.0
Annapolis, Md.	9.05	9.55	5.5	...
Baltimore	8.45	8.95	5.5	8.8
Cumberland	9.85	10.35	5.5	10.3
Washington, D. C.	8.70	9.20	4.5	9.3
Danville, Va.	9.60	10.10	6.5	9.7
Petersburg	9.25	9.75	6.5	9.3
Norfolk	8.70	9.20	6.5	9.0
Richmond	9.00	9.50	6.5	9.3
Roanoke	10.20	10.70	6.5	10.0
Charleston, W. Va.	10.30	10.80	6.5	11.1
Parkersburg	10.30	10.80	6.5	10.8
Wheeling	10.05	10.55	6.5	11.4
Charlotte, N. C.	9.80	10.30	7.5	9.6
Hickory	10.20	10.70	7.5	10.6
Mt. Airy	10.40	10.90	7.5	9.8
Raleigh	10.10	10.60	7.5	10.6
Salisbury	9.90	10.40	7.5	11.0
Charleston, S. C.	9.20	9.70	7.5	...
Columbia	10.10	10.60	7.5	...
Spartanburg	9.60	10.10	7.5	...
New Orleans, La.	8.45	8.95	8.5	**8.5
Baton Rouge	8.45	8.95	8.5	**9.0
Alexandria	8.45	8.95	8.5	**9.0
Lake Charles	8.70	9.20	8.5	**10.5
Shreveport	8.20	8.70	8.5	**7.5
New Iberia, La.	°8.70	°9.20	8.5	8.5
Knoxville, Tenn.	°9.95	°10.45	8.5	11.0
Memphis	°8.90	°9.40	8.5	9.0
Chattanooga	°9.70	°10.20	8.5	9.5
Nashville	°10.20	°10.70	8.5	8.5
Bristol	°9.45	°9.95	8.5	10.5
Little Rock, Ark.	°9.20	°9.70	8.0	10.5

°Effective Feb. 13; shown incorrectly in NPN of Feb. 20 & 27.

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J.	13	14.5
Baltimore, Md.	15.5	....
Washington, D. C.	15.5	....

Fuel Oils—T.W.	No. 1	No. 2
Atlantic City, N. J.	9.0	8.0
Newark	9.0	8.0
Baltimore, Md.	8.8	8.0
Washington, D. C.	9.3	8.4
Norfolk, Va.	9.0	7.8
Petersburg	9.3	8.0
Richmond	9.3	8.0
Charlotte, N. C.	9.6	9.4
Hickory	...	9.0
Raleigh	10.6	9.1
Charleston, S. C.	...	8.0
Columbia	...	9.0
Spartanburg	...	9.8

**Includes 1.0c per gallon State Tax.

Discounts:

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—1c off t.w. price for 25 gals. or more, under contract, through territory, except no discount in states of New Jersey, Virginia, Tennessee, Louisiana, Maryland & Delaware and District of Columbia.

Naphtha—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

S. O. OHIO

Sohio X-70 Gasoline (*Regular Grade*)**

	Con-sumer T.W.	Re-sellers	°S.S.	Gaso-line Taxes	†Kero-sine T.W.
Ohio, Statewide.	††12	10	13.5	5.5	9.8
Akron	12	9.5	12.5	5.5	9.8
Canton	12	9.5	12.5	5.5	9.8
Cincinnati	12	9.5	12.5	5.5	9.8
Cleveland	12	9.5	12.5	5.5	9.8
Columbus	12	9.5	12.5	5.5	9.8
Dayton	12	9.5	12.5	5.5	9.8
Lima	12	9.5	12.5	5.5	9.8
Mansfield	12	9.5	12.5	5.5	9.8
Marion	12	9.0	12.0	5.5	9.8
Portsmouth	12	9.5	12.5	5.5	9.8
Toledo	12	9.5	12.5	5.5	9.8
Youngstown	12	9.5	12.5	5.5	9.8
Zanesville	12	9.5	12.5	5.5	9.8

Aviation Gasoline—Statewide

	Consumer Gasoline T.W.	Taxes
Sohio Aviation Gasoline Clear Spec. AN-F-22, Amend. 1	14.5	5.5
Esso Ethyl Avia. Grade 73	15.5	5.5
Esso (Clear) Avia. Grade 80	16.5	5.5
Esso Aviation Grade 91/98.	17.5	5.5
Esso Aviation Grade 100/130	20.5	5.5

†Naphtha—T.W.	Statewide
S. R. Solvent	13.5
D. C. Naphtha	14
V.M.&P. Naphtha	14
Varnolene	14
Sohio Solvent	14

Fuel Oils—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.8	8.8	8.3	*7.55

**Renown (third-grade) prices are same as X-70 unless otherwise noted.

*Prices at company-operated stations.

†Kerosine prices are ex 1c state tax. Naphtha prices are ex 1.5c federal and 4c state tax.

††Statewide prices are subject to exceptions other than those shown

Discounts:

Esso aviation—on contract to hangar operators and resellers 2c off consumer t.w.

*For Cleveland area only. Full compartment hose dumps.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals. 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

TEXAS CO.

	Gasoline—Dealer T.W. Fire-Chief (*Regular*)	Indian (*3rd Grade*)	Gaso-line Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	7.5	6.5	5.5
Wichita Falls, Tex.	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8.5*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers.

Notice

Tank Wagon prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 2/25c; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Neb. 2/100c; Nev. 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/40c; Tenn. 2/5c; and Wisc. 3/100c.

Kerosine inspection fees only: Ala. 1/2c; Fla. 1/8c; Iowa 3/50c; Mich. 1/5c per gal.

Atlantic Coast

(Prices are of refiners, FOB their refineries and tanker terminals, and of tanker terminal operators FOB their terminals)—Prices in Effect March 4

Seaboard Export Coastwise Prices

	MOTOR GASOLINE (ASTM Octane)				KEROSINE & FUEL OILS				
District	74-75 Oct.	76-79 Oct.	80-83 Oct. (Ethyl)	Min. 83 Oct. (Ethyl)	KEROSINE &/OR NO. 1 FUEL	NO. 2 FUEL	NO. 3 FUEL	No. 5	No. 6
N. Y. Harb.	7(1)	7 – 8	8 –8.95(2)	8(1) – 7.9(1)	6.1	5.7	5.7 (1)	$1.59-1.69(a)	$1.51
N. Y. Harb., barges	6.9(1)	6.9 – 7.6	7.9(1)	7.9(1)	6	5.6	5.6 (1)	....	....
Albany	7.1(1)	7.1 – 7.8	8.1(1)	9.3(1)	6.3	5.8	5.8 (1)	....	$1.71 (1)
Philadelphia	7(2)	7 – 8	8 – 8.95	8(2)	6.2	5.7	5.7	$1.72 (2)	$1.51
Philadelphia barges,	....	6.9(1)	....	7.9(1)					
Baltimore	6.5-7(2)	6.5 – 7.45	7.5 – 8.7	8(2)	6.2	5.7	5.7 (2)	$1.59 (1)	$1.51
Baltimore barges...	....	6.9(1)	....	7.9(1)					
Norfolk	6.8(1)	6.8 – 7.1	7.8(1)	....	6.1	5.7	....	$1.55 (1)	$1.47
Wilmington, N. C...	6.65(1)	6.65 – 7.35	7.65–7.95(2)	....	6.05	5.7	....	....	....
Charleston	6.65(1)	6.65 – 7.05	7.65(2)	....	6.2	5.7	....	$1.50 (1)	$1.42 (2)
Savannah	....	7 – 7.37	8(2)	....	6.05	5.25	5.25 (1)	....	$1.42 (1)
Jacksonville	....	7 – 7.375	8 – 8.375	....	6.05	5.25	....	....	$1.42
Miami	....	7 – 7.375	8 – 8.375	....	6.05	5.25 (2)	....	....	....
Tampa	....	7 – 7.375	8 – 8.375	....	6.05	5.25	....	....	$1.32
Pensacola	....	6.625–7(2)	....	....	5.3 (1)	5.25 (1)	....	....	....
Mobile	....	6.5–6.87(2)	....	....	5.25 (2)	....	....	....	....
New Orleans	5.7(2)	6(1)	6.45(2)	....	4.625	4.25 (2)	....	$1.05 (1)	$0.97
Portland	7.1(1)	7.9 – 8.1	8.1–9.15(2)	9.4(1)	6.3	5.8	5.8 (1)	....	$1.555
Boston	7.1(1)	7.1 – 7.8	8.1–9.05(2)	8.1–9.3(2)	6.2	5.8	5.8 (1)	$1.735 (2)	$1.555
Providence	7.1(1)	7.8 – 8	8.1–9.05(2)	9.3(1)	6.2	5.8	5.8 (1)	$1.635 (1)	$1.525
New Haven	....	....	....	....	....	....	....	....	$1.525

(a) $1.59 semi-refined.

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
N. Y. Harbor	$1.51	$2.36	5.7 (1)	5.8 (2)
Albany	$1.71 (1)	$2.52 (1)	5.8 (1)	6 (1)
Philadelphia	$1.51	$2.36	....	....
Baltimore	$1.51 (2)	$2.36 (2)	5.7 (1)	....
Norfolk	$1.47	$2.36 (2)	5.7 (1)	....
Charleston	$1.42 (2)	$2.36 (2)	5.7 (1)	....
Savannah	$1.42 (1)	....	....	....
Jacksonville	$1.42	$2.20 (1)	....	....
Tampa	$1.32	....	....	....
New Orleans	$0.97	$1.86 (1)	....	....
Portland	$1.555	....	5.8 (1)	5.9 (1)
Boston	$1.555	$2.40 (1)	5.8 (2)	5.9 (1)
Providence	$1.525	$2.402 (2)	5.8 (1)	5.9 (1)
New Haven	$1.525 (1)	....	....	....

Gulf Coast

Prices in Effect March 4

MOTOR GASOLINE Leaded (oct. by ASTM)	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	New Orleans & Lower Mississippi to Baton Rouge Barges	Texas Gulf Coast South of New Orleans Tank Cars	Texas Gulf Coast South of New Orleans Barges	CARGOES Domestic & Export From all Gulf Ports
78-80 oct.	6.45 (2)	6.2 (2)	6.45–6.75(2)	6.2 – 6.75(2)	6.2 – 6.75
73-75 oct.	5.7 – 6	5.45(2)	5.7 – 6 (a)	5.45 – 5.75	5.25 – 5.75
70 oct.	....	....	....	....	5 – 5.25
Min. 80 oct., research, max. 2 cc. lead	....	....	....	....	5.25
Unleaded 70 oct.	....	....	....	....	5.25
67-68 oct.	....	....	....	....	....
65 oct.	....	....	....	....	4.875
60 oct.	....	....	....	....	4.625
KEROSINE & LIGHT FUELS					
41-43 w.w. kero.	4.625	4.625	4.625	4.625	4.625
42-44 w.w. kero.	....	....	4.625	4.625	4.625
No. 2 fuel oil	4.25	4.25	4.25	4.25	4.25
DIESEL & GAS OILS (In diesel index No.)					
No. 5 fuel oil	$1.05	....	$1.05	....	....
43-47 di.	....	....	....	....	4.5
48-52 di.	4.5	4.5	4.5	4.5	4.5
53-57 di.	4.625	....	4.625	4.625	4.625
58 and above	4.75	....	4.75	....	4.75

(a) One refiner quotes 5.75c for Dist. 1 shipment, 6c for other districts; four other refineries quote 5.7 to 5.75c for unrestricted shipment.

NOTE: Above products in Truck Transports of 2,400 gal. and over 0.125c above Tank Car Prices.

HEAVY FUELS & BUNKER OIL (all Gulf Ports) Heavy Diesels	In Cargoes	In Ship's Bunkers (Ex Lighterage)
Below 28 API Grav.	....	$1.35 –$1.56
28 & above API Grav.	....	$1.86
Bunker C Oil...	$0.97	$0.97

TANKER RATES

Approximate rates, cents per bbl.; Gulf-N. Atlantic, not east of New York

Heavy crude & fuel, 10-19.9 grav....	43.8
Light crude, 30 grav. or lighter.....	39
Gasoline.....	32.9
Kerosine.....	36
No. 2 fuel.....	38

Mid-Continent Lubes

(At Gulf; in packages, FAS. New Orleans; in bulk, FOB terminals).

Prices in Effect March 4

Bright Stock *D color, Vis at 210°*	Steel Drums	Bulk
150 vis., 0-10 p.p.	32.65 (1)	24.8 (1)

Pacific Coast

(In Ships' Bunkers, or Deep Tank Lots)

	Prices in Effect March 4 Diesel Fuel (P.S. 200)	Bunker C Fuel (P.S. 400)
San Pedro, Calif.	$1.765(1)	$1.10(1)
San Francisco, Calif.	1.815(1)	1.15(1)
Portland, Ore.	2.015(1)	1.30(1)
Seattle, Wash.	2.015(1)	1.30(1)

Wax

(Melting points are AMP, 3° higher than EMP. Prices are FOB refinery and do not include bag; freight or export differentials).

Prices in Effect March 4

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25 (1)	....	4.25 (1)
122-4 White	....	4.25 (2)	4.25(2)
124-6 White....	4.25 (1)	4.25	4.25
Fully Refined:			
123-5.....	5.2 (1)	5.2 (2)	5.2 (1)
125-7.....	5.2 (1)	5.2 (2)	5.2 (2)
128-30.....	5.6 (1)	5.6	5.6 (1)
130-32.....	5.85 (1)	5.85 (2)	5.85 (1)
133-5.....	6.15 (1)	6.15	6.15 (2)
135-7.....	6.4 (1)	6.4 (1)	6.4 (1)

Naphtha

Effective March 4

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor.	11 (2)	10
Philadelphia.....	11 (2)	10
Baltimore.....	10.5 (2)	9.5
Boston.....	11.5 (2)	10.5
Providence.....	11.5 (1)	10.5 (2)

Export Prices

Prices in Effect March 4

	Mexican Gulf Ports U. S. Dollars per Bbl. Bunker C (Ships' Bunkers)	Diesel (Ships' Bunkers)
Tampico.....	$0.97	$1.86*
Veracruz.....	0.97	....
Coatzacoalcos....	0.97	1.86*
	Pacific Coast	
Guaymas.....	$1.50	$3.22
Mazatlan.....	1.50	3.22
Acapulco.....	1.50	2.89
Manzanillo.....	1.50	2.89
Salina Cruz.....	1.50	2.89

Note: All bunkers sales subject to Mexican stamp tax of 1.65% ad valorem.

*This price correct for Feb. 18 also.

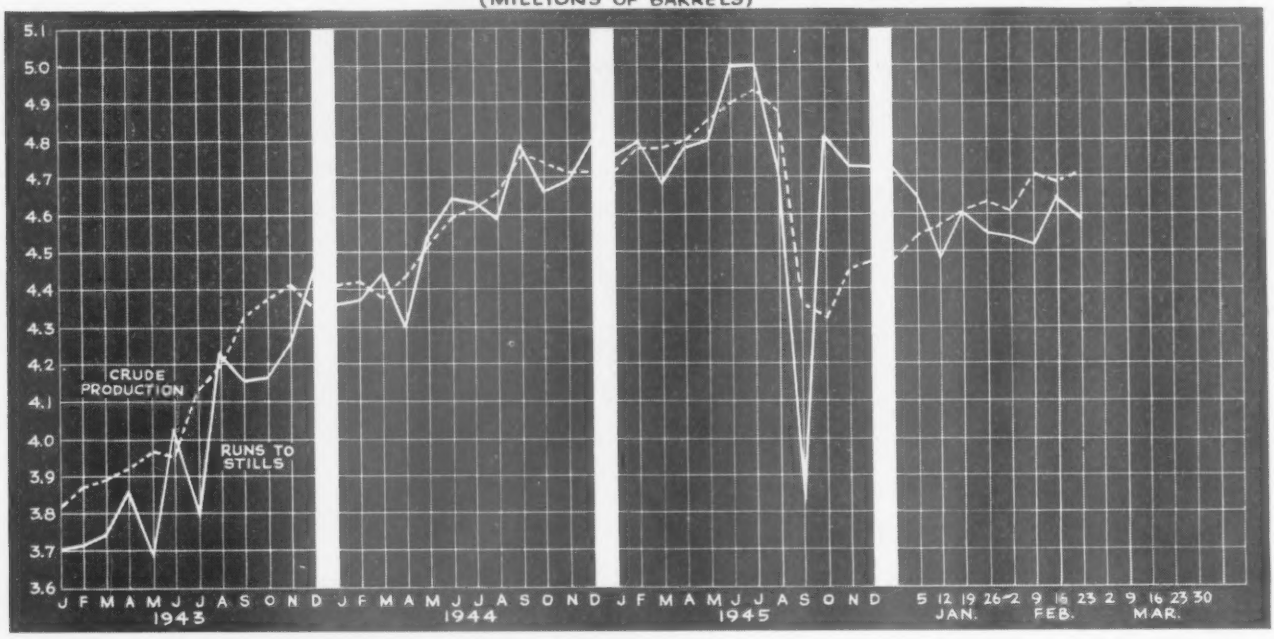
NPN Gasoline Index

	Dealer T.W.	Tank Car
	Cents Per Gal.	
March 4.....	9.75	6.17
Month ago.....	9.89	6.45
Year ago.....	10.37	6.73

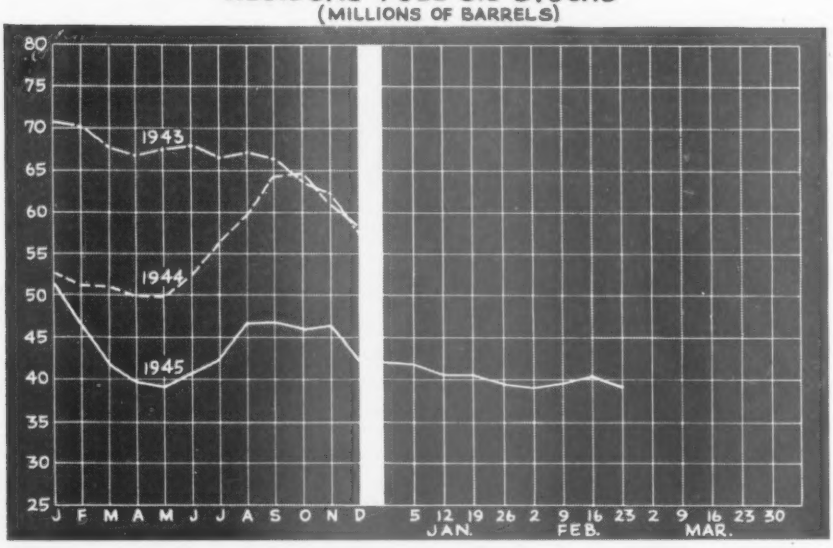
Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

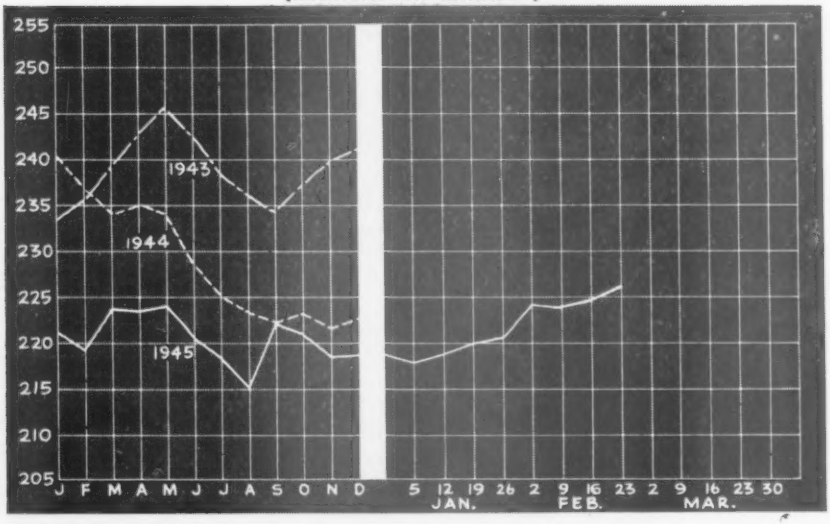
CRUDE PRODUCTION AND RUNS TO STILLS
(MILLIONS OF BARRELS)



RESIDUAL FUEL OIL STOCKS
(MILLIONS OF BARRELS)



CRUDE OIL STOCKS
(MILLIONS OF BARRELS)



Iran Crude Production

(Output of Anglo-Iranian Oil Co., Ltd.)

1939	9,583,285 tons
1940	8,626,639 tons
1941	6,605,320 tons
1942	9,399,231 tons
1943	9,705,769 tons
1944	13,274,243 tons
First 11 months of 1945	15,217,000 tons

Crude Oil Stocks

Bureau of Mines Figures in thousands of bbls.)

Grade or Origin	Feb. 16	Feb. 23	Change from Feb. 16
Penna. Grade	2,047	2,018	— 29
Other Appalachian	1,437	1,514	+ 77
Lima-Michigan	1,041	1,023	— 18
Illinois-Indiana	16,565	17,114	+ 579
Arkansas	2,300	2,363	+ 63
Kansas	9,523	9,458	— 65
Louisiana	12,162	11,967	— 195
North	3,054	3,170	+ 116
Gulf Coast	9,108	8,797	— 511
Mississippi	2,429	2,342	— 87
New Mexico	5,571	5,865	+ 294
Oklahoma	34,629	34,927	+ 298
Texas	107,202	107,613	+ 411
East Texas	16,650	16,762	+ 112
West Texas	35,868	36,140	+ 272
Gulf Texas	28,984	29,407	+ 423
Other Texas	25,700	25,304	— 396
Panhandle	4,252	4,332	+ 78
North	6,421	6,117	— 304
South	5,676	5,592	— 84
Other	9,349	9,263	— 86
Rocky Mountain	7,647	7,773	+ 126
California	19,412	19,567	+ 155
Foreign	2,797	3,125	+ 328
Total gasoline-bearing in U. S.	224,762	226,669	+1,907
Heavy in California	4,577	4,438	— 139
Total located in Bureau of Mines East Coast district	12,682	13,251	+ 569

REFINING OPERATIONS

(American Petroleum Institute figures in thousands of barrels of 42 gallons each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Average Crude Runs to Stills Week Ended		Gasoline Production at Refineries inc. Natural Blended Week Ended		Kerosine Production Week Ended		Gas Oil & Dist. Fuel Oil Production Week Ended		Residual Fuel Oil Production Week Ended	
	Feb. 23	Feb. 16	Feb. 23	Feb. 16	Feb.23	Feb. 16	Feb. 23	Feb. 16	Feb. 23	Feb. 16
East Coast	797	784	1,583	1,641	406	297	1,067	1,132	1,719	1,965
Appalachian (Dist. 1)	93	95	285	293	80	74	55	83	65	70
Appalachian (Dist. 2)	57	60	195	199	13	17	53	58	79	87
Ind., Ill., Ky.	728	707	2,456	2,527	372	336	763	746	921	981
Inland Texas	394	383	1,429	1,375	207	216	435	377	481	522
Okla., Kans., Mo.	197	207	790	826	113	111	108	107	307	361
Texas Gulf Coast	1,135	1,182	3,364	3,878	816	788	1,672	1,803	1,629	1,692
Louisiana Gulf Coast	303	305	679	751	313	313	462	454	325	276
No. La. & Arkansas	58	55	167	149	36	27	44	53	96	78
Rocky Mt. (Dist. 3)	12	12	39	37	5	5	11	11	31	31
Rocky Mt. (Dist. 4)	101	103	371	363	25	24	83	95	192	193
California	720	750	1,817	1,963	51	77	975	857	2,068	2,557
Total U. S.—B. of M. Basis Feb. 23, 1946	4,595	4,643	13,175	14,002	2,437	2,285	5,728	5,776	7,913	8,813
U. S.—B. of M. Basis, Feb. 24, 1945	4,846	4,835	15,785	15,249	1,655	1,465	5,152	5,240	9,253	9,390

Districts	Total Stocks Kerosine Week Ended		Total Stocks Gas Oil and Distillates Week Ended		Total Stocks Residual Fuel Oil Week Ended		Stocks of Finished and Unfinished Gasoline Week Ended		Per Cent Daily Refining Capacity Reported Week Ended	
	Feb. 23	Feb. 16	Feb. 23	Feb. 16	Feb. 23	Feb. 16	Feb. 23	Feb. 16	Feb. 23	Feb. 16
East Coast	3,448	3,657	7,532	8,116	6,446	6,591	23,373	22,645	99.5	99.5
Appalachian (Dist. 1)	133	176	442	477	296	305	2,819	3,082	76.8	76.8
Appalachian (Dist. 2)	18	18	83	84	287	285	1,199	1,177	81.2	81.2
Ind., Ill., Ky.	1,197	1,219	3,206	3,453	3,159	3,087	23,122	22,988	87.2	87.2
Okla., Kans., Mo.	295	319	1,333	1,321	1,047	1,022	10,006	9,978	78.3	78.3
Inland Texas	236	209	280	275	578	666	3,096	3,140	59.8	59.8
Texas Gulf Coast	1,477	1,173	4,456	4,782	4,370	4,130	16,014	17,082	89.3	89.3
Louisiana Gulf Coast	814	693	1,546	1,565	1,177	1,248	4,751	5,347	96.8	96 8
N. La. & Arkansas	147	279	423	494	216	217	2,002	1,723	55.9	55.9
Rocky Mt. (Dist. 3)	20	20	27	27	30	29	107	105	17.1	17.1
Rocky Mt. (Dist. 4)	90	115	356	361	636	669	2,207	2,141	72.1	72.1
California	544	558	6,214	6,318	21,048	21,787	16,013	15,825	86.5	86.5
Total U. S.—B. of M. Basis Feb. 23, 1946	8,419	8,436	25,898	27,273	39,290	40,036	(a)104,709	105,233	85.7	85.7
U. S.—B. of M. Basis, Feb. 24, 1945	7,276	7,521	27,672	28,787	46,711	48,150	(b)96,448	95,373		

Unfinished gasoline stocks included are: (a) 8,626,000 bbls.; (b) 12,190,000 bbls.

Daily Av. Pennsylvania Crude Runs

(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)

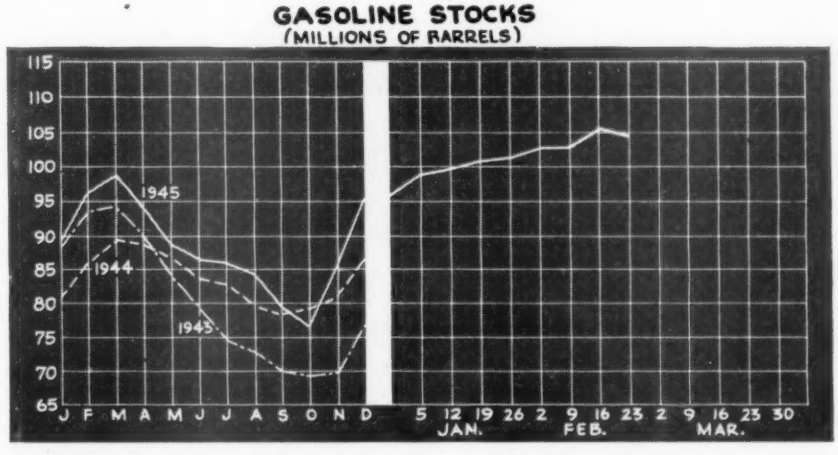
Week Ended Feb. 23, 1946	Week Ended Feb. 16, 1946	Week Ended Feb. 24, 1945
55,910	57,376	55,464

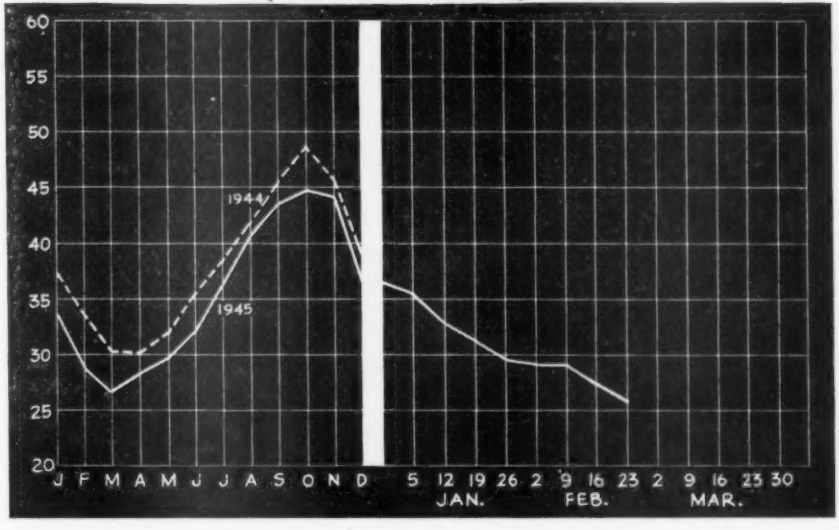
U. S. Crude Oil Production

(American Petroleum Institute figures)

	WEEK ENDED Feb. 23 Barrels (Daily Average)	Feb. 16 Barrels (Daily Average)
Oklahoma	*390,050	389,450
Kansas	*253,650	259,650
Nebraska	*850	750
Texas	2,109,250	2,109,250
Louisiana	370,850	368,000
Arkansas	77,500	77,500
Mississippi	52,850	55,100
Alabama	1,050	1,000
Florida	100	100
Illinois	211,000	208,350
Indiana	17,100	16,250
Eastern (Ill., Ind. & Ky. excluded)	61,300	63,800
Kentucky	30,400	29,950
Michigan	45,300	42,100
Wyoming	104,000	103,400
Montana	19,100	19,050
Colorado	24,450	24,050
New Mexico	98,450	98,450
California	846,400	843,700
Total, U. S.	4,713,650	4,709,950

*Okla., Kans., Neb. figures are for week ended 7 a.m. Feb. 20.





Pacific Coast Demand

(Bureau of Mines figures in thousands of bbls. daily.)

	Gasoline		Gas Oil & Diesel		Heavy Fuel Oil		All Products	
	1944	1945	1944	1945	1944	1945	1944	1945
January	275	304	103	104	505	545	993	1,066
February	315	315	109	100	478	594	1,011	1,124
March	311	332	108	94	479	519	1,018	1,068
April	302	406	88	83	450	536	954	1,148
May	295	402	85	75	411	520	900	1,135
June	352	398	87	64	395	490	969	1,085
July	335	396	63	59	353	421	884	1,011
August	329	370	63	78	349	434	883	1,010
September	323	363	65	76	382	400	902	954
October	313	269	70	76	450	443	945	897
November	328	271	80	106	467	418	992	901
December	319	265	101	117	558	479	1,093	969
Jan.-Dec.	316	340	85	86	440	482	962	1,030

Midcontinent Lubricating Oils

(All figures are in barrels of 42 gallons)

	Bright Stock	Viscous Neutrals	Paraffin Oils	Steam Refined Stock	Blended Oils
Production	219,094	271,048	73,536	20,005	309,808
Shipments:					
Domestic	154,939	248,485	65,975	13,878	274,830
Export	1,572	2,499	42	189	16,247
TOTAL	156,511	250,984	66,017	14,067	291,077
Inventory Dec. 31, 1945	352,311	256,235	67,489	40,504	183,019
Days Supply	48	25	.....	.....	.....

Pennsylvania Lubricating Oils

(Compiled by National Petroleum Assn. from reports of companies refining Pennsylvania Grade crude oil. Figures in bbls.)

	Production Dec., 1945	Inventory Dec., 1945	Production Nov., 1945	Inventory Nov., 1945
Raw Long Residuum	35,154	30,812	38,369	46,406
600 Steam Refined Stock	248,433	104,838	268,071	112,864
Other Steam Refined Stock	41,786	39,357	48,523	39,100
Finished Dewaxed Long Residuum	40,440	25,557	52,118	30,250
Bright Stock	168,829	234,086	164,077	196,026
Viscous Neutral (below 180 Vis.)	55,214	136,151	52,991	140,067
Viscous Neutral (180 Vis. at 100)	113,105	93,516	93,349	78,838

Production of Natural Gasoline

(Bureau of Mines Figures)

	Dec., 1945	Nov., 1945
East Coast	.....	.....
W. New York	1	.....
W. Pennsylvania	1,255	1,206
West Virginia	10,576	9,608
Ohio	632	575
Illinois	14,091	14,431
Kentucky	5,131	4,672
Michigan	1,109	1,128
Kansas	6,833	7,128
Oklahoma	35,929	34,942
Texas	186,864	178,233
Gulf	45,674	43,611
East Texas	25,511	26,629
Panhandle	49,534	47,482
Other	66,145	60,618
Arkansas	7,539	6,329
Louisiana	50,080	46,923
Gulf	27,493	27,084
Inland	22,587	19,839
New Mexico	7,197	7,931
Colorado	*	*
Montana	527	467
Wyoming	*3,250	*3,390
California	73,483	70,923
Total	404,497	387,825
Daily average	13,048	12,927
Total (thousands of bbls.)	9,631	9,234
Daily average	311	311

* Wyoming includes Colorado drip gasoline.

Dealer and Service Station Gasoline in 50 Representative U. S. Cities February 1, 1946

(American Petroleum Institute Figures)

City	Dealers' Net Price (Ex. Tax)	Indicated Dealer Margin	Gasoline Tax (Inc. 1½ Cent Federal Tax)	Service Station (Inc. Tax)
Portland, Me.	9.60	4.0	5.50	19.10
Manchester, N. H.	10.60	4.1	5.50	20.20
Burlington, Vt.	10.20	4.0	5.50	19.70
Boston, Mass.	9.20	4.0	4.50	17.70
Providence, R. I.	9.30	4.5	4.50	18.30
Hartford, Conn.	9.90	4.0	4.50	18.40
Buffalo, N. Y.	9.50	4.5	5.50	19.50
New York, N. Y.	9.40	5.4	5.50	20.30
Newark, N. J.	9.00	5.0	4.50	18.50
Philadelphia, Pa.	9.00	4.0	5.50	18.50
Dover, Del.	9.50	4.2	5.50	19.30
Baltimore, Md.	8.75	3.95	5.50	18.20
Washington, D. C.	9.00	4.0	4.50	17.50
Charleston, W. Va.	10.60	4.00	6.50	21.10
Norfolk, Va.	9.00	5.80	6.50	21.30
Charlotte, N. C.	10.10	4.80	7.50	22.40
Charleston, S. C.	9.50	5.00	7.50	22.00
Atlanta, Ga.	10.50	4.0	7.50	22.00
Jacksonville, Fla.	9.50	4.0	8.50	22.00
Birmingham, Ala.	10.00	5.0	8.50	*23.50
Vicksburg, Miss.	9.50	5.0	7.50	22.00
Memphis, Tenn.	8.90	4.5	8.50	21.90
Lexington, Ky.	10.50	3.5	6.50	20.50
Youngstown, Ohio	9.50	3.0	5.50	18.00
South Bend, Ind.	10.20	4.80	5.50	20.50
Chicago, Ill.	9.60	2.76	4.50	16.86
Detroit, Mich.	9.60	3.74	3.84	17.94
Milwaukee, Wisc.	10.50	4.3	4.40	20.40
Twin Cities, Minn.	10.10	4.40	5.50	20.00
Fargo, N. Dak.	11.10	4.0	5.50	20.60
Huron, S. Dak.	10.50	4.00	5.50	20.00
Omaha, Neb.	9.60	3.0	6.50	19.10
Des Moines, Ia.	9.60	3.5	5.50	18.90
St. Louis, Mo.	9.50	3.0	4.50	*17.00
Wichita, Kans.	8.60	3.2	3.40	16.50
Tulsa, Okla.	8.00	3.0	9.00	20.00
Little Rock, Ark.	9.50	4.5	8.00	22.00
New Orleans, La.	8.75	4.75	8.50	22.00
Houston, Tex.	8.50	4.5	5.50	18.50
Albuquerque, N. Mex.	10.50	4.5	7.00	**22.00
Denver, Colo.	10.00	4.0	5.50	19.50
Casper, Wyo.	11.50	5.0	5.50	22.00
Butte, Mont.	9.50	4.0	6.50	20.00
Boise, Ida.	13.50	4.0	7.50	25.00
Salt Lake City, Utah	13.50	4.5	5.50	23.50
Reno, Nev.	12.00	4.0	5.50	21.50
Phoenix, Ariz.	12.00	4.0	6.50	22.50
San Francisco, Calif.	10.00	4.0	4.50	18.50
Portland, Ore.	10.50	4.0	6.50	21.00
Spokane, Wash.	12.50	4.0	6.50	23.00

* Includes city tax of 01.00.
** Includes city tax of 00.50.

Pennsylvania Oils Other Than Lubes at Refineries

(Compiled by National Petroleum Assn. from reports of oil region refiners. Figures in barrels.)

	Dec. 1945	Nov. 1945
Naphthas & Gasoline		
(1) Straight run, unblended and/or unleaded for sale as motor fuel	4,130	2,956
(2) Naphtha and gasoline, for sale for blending or further refining, or held at refinery for further distillation, reforming, blending or leading	295,070	212,206
(3) Below 65 octane, not included in (1) or (2) above	1,245	1,248
(4) 65 octane and above	392,707	325,245
Salable Naphthas other than motor fuel (does not include refinery process naphthas)	19,226	17,031
Kerosine	81,816	79,030
36/40 gas oil (include furnace oil)	48,122	76,848
Fuel oil (not reported above)	42,641	28,431
Oils held as cracking plant charging stocks	362,091	393,401
Non-viscous neutral	23,190	26,974
Wax distillate	72,427	90,894
Crude petrolatum	40,189	35,258
Wax (lbs.)	4,564,437	3,923,250

Net Stocks of Pennsylvania Crude Oil

(Compiled by National Petroleum Assn. Figures in bbls.)

	Dec. 31, 1945	Nov. 30, 1945	Dec. 31, 1944
At Refineries	310,930	329,469	296,785
Pipeline and Tank Farm	1,278,770	1,411,280	1,332,243
Total	1,589,700	1,740,749	1,629,028

Deaths

Joseph M. Alexander, manager of the order deparment, Globe Oil Refining Co., Chicago, died at Wesley Memorial Hospital Feb. 28, following an illness of about three months. He was buried Sunday at Joliet, Ill., his home town. He was with the Globe for about 15 years previous to his death.

° ° °

Carl E. Miller, Western manager of James B. Berry Sons Co. died at Wesley Memorial Hospital, Chicago, at noon on Feb. 28. Mr. Miller was with Berry for 20 years. His home was in Evanston, Ill.

° ° °

Funeral services were held in Terre Haute, Ind., Feb. 28 for **L. V. Surtees,** manager of Mid-Continent Petroleum Corp.'s eastern sales division with headquarters in Terre Haute. Mr. Surtees died Feb. 26 at the age of 51. He had been associated with Mid-Continent and predecessor firms for many years.

Funeral services were held in Fort Worth Feb. 28 for **John E. Farrell,** 54, well-known Southwestern oil operator, who died from a heart attack. Mr. Farrell was a native of England and came to this country when 17. He worked for various oil, railroad and mining companies before going into business for himself in 1929. He was a member of the American Petroleum Institute.

° ° °

William D. Anderson, 72, who retired in 1943 as first vice president of Atlantic Refining Co. after being connected with company for 45 years, died in Philadelphia Feb. 26. Mr. Anderson was made chevalier of Legion of Honor by French government for his work during First World War in expediting transportation of oil products to Europe. He is survived by his wife.

CRUDE PRICES

Since changes in crude oil prices are few, the two pages of crude oil prices tables are printed only when there are sufficient changes to warrant.

A record is kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers.

Crude Price Changes

No price changes for week ending *Feb.* 27.

For latest table of crude prices published, see NPN Feb. 27, *pages* 54, 55 *and* 57.

Service Station Retail Sales Up

NPN News Bureau

WASHINGTON—Retail sales of independent service stations in 34 states showed an "outstanding" gain last month of 48% over January, 1945, to lead the nondurable goods trades, Census Bureau reports. Rate of increase was 30% higher than that recorded for drug stores, and over-shadowed food stores and eating and drinking places 35%. Service station sales also were 8% higher than December, 1945, although most other types of retail establishments suffered declines in sales during the same period.

Bureau's data were based upon reports from 10,766 independent retailers in 34 states.

GASOLINE CONSUMPTION BY STATES, NOVEMBER 1945

(American Petroleum Institute Figures)

	Tax Rate* November Cents	Month of October, 1945 Gallons	Month of November, 1945 Gallons	Month of November, 1944 Gallons	Change %	11 Months Ending With November, 1945 Gallons	11 Months Ending With November, 1944 Gallons	Change %
Alabama	6	28,702,000	28,572,000	22,609,000	+26.37	279,812,000	239,953,000	+16.61
Arizona	5	12,293,000	12,682,000	9,521,000	+33.20	119,233,000	119,188,000	+ 0.04
Arkansas	6½	19,482,000	19,488,000	16,084,000	+21.16	194,498,000	164,201,000	+18.45
California	3	256,751,000	250,862,000	199,741,000	+25.59	2,533,117,000	2,206,280,000	+14.81
Colorado	4	24,022,000	21,449,000	22,695,000	— 5.48	276,356,000	275,724,000	+ 0.23
Connecticut	3	27,530,000	26,188,000	22,138,000	+18.29	273,672,000	250,179,000	+ 9.39
Delaware	4	5,125,000	4,676,000	3,776,000	+23.83	50,477,000	46,460,000	+ 8.65
District of Columbia	3	11,398,000	10,954,000	9,115,000	+20.18	107,234,000	99,519,000	+ 7.75
Florida	7	38,288,000	40,577,000	31,504,000	+28.80	383,694,000	347,149,000	+10.53
Georgia	6	41,030,000	41,085,000	31,465,000	+30.57	395,109,000	344,270,000	+14.77
Idaho	6	12,162,000	9,401,000	7,730,000	+21.62	102,316,000	88,601,000	+15.48
Illinois	3	115,822,000	114,817,000	94,873,000	+21.02	1,167,804,000	1,078,584,000	+ 8.27
Indiana	4	63,863,000	61,935,000	56,258,000	+10.09	705,961,000	650,231,000	+ 8.57
Iowa	3	56,269,000	53,879,000	45,628,000	+18.08	558,640,000	492,681,000	+13.39
Kansas	3	44,008,000	38,168,000	32,230,000	+18.42	459,094,000	413,448,000	+11.04
Kentucky	5	31,206,000	29,958,000	25,124,000	+19.24	340,703,000	270,027,000	+26.17
Louisiana	7	32,459,000	31,749,000	25,735,000	+23.37	315,801,000	280,974,000	+12.40
Maine	4	13,861,000	11,883,000	10,402,000	+14.24	134,181,000	120,685,000	+11.18
Maryland	4	29,259,000	26,518,000	25,496,000	+ 4.00	303,393,000	268,810,000	+12.87
Massachusetts	3	57,252,000	52,004,000	45,716,000	+13.75	547,072,000	491,823,000	+11.23
Michigan	3	109,842,000	96,541,000	90,929,000	+ 6.17	1,077,026,000	999,032,000	+ 7.81
Minnesota	4	54,797,000	47,302,000	40,256,000	+17.50	494,217,000	431,198,000	+14.61
Mississippi	6	19,837,000	24,408,000	18,806,000	+29.79	215,902,000	191,893,000	+25.02
Missouri	2	54,431,000	54,677,000	42,559,000	+28.47	538,016,000	476,909,000	+12.81
Montana	5	12,833,000	9,687,000	8,144,000	+18.95	124,033,000	108,933,000	+13.86
Nebraska	5	25,111,000	22,902,000	18,605,000	+23.10	247,958,000	217,592,000	+13.96
Nevada	4	5,197,000	4,341,000	4,728,000	— 8.19	47,807,000	57,981,000	—17.55
New Hampshire	4	7,474,000	6,604,000	5,263,000	+26.13	69,934,000	61,431,000	+13.84
New Jersey	3	60,864,000	63,536,000	57,764,000	+ 9.99	683,857,000	635,333,000	+ 7.64
New Mexico	5	11,804,000	11,766,000	9,764,000	+20.50	118,358,000	101,378,000	+16.75
New York	4	139,378,000	134,115,000	118,791,000	+12.90	1,362,111,000	1,278,872,000	+ 6.51
North Carolina	6	50,372,000	47,779,000	33,610,000	+42.16	434,295,000	376,946,000	+15.21
North Dakota	4	21,113,000	11,615,000	10,306,000	+12.70	181,981,000	163,031,000	+11.62
Ohio	4	126,156,000	110,527,000	113,793,000	— 2.87	1,290,286,000	1,265,376,000	+ 1.97
Oklahoma	7½	46,004,000	36,579,000	38,937,000	— 6.06	537,341,000	430,809,000	+24.73
Oregon	5	28,430,000	23,550,000	20,133,000	+16.97	256,342,000	241,437,000	+ 6.17
Pennsylvania	4	121,929,000	116,064,000	95,276,000	+21.82	1,152,234,000	1,042,970,000	+10.48
Rhode Island	3	10,505,000	9,449,000	11,133,000	—15.13	114,481,000	109,444,000	+ 4.53
South Carolina	6	21,686,000	22,109,000	16,616,000	+33.06	204,699,000	180,862,000	+13.18
South Dakota	4	17,290,000	13,375,000	10,686,000	+25.16	147,981,000	124,819,000	+18.56
Tennessee	7	39,144,000	38,046,000	28,704,000	+32.55	348,132,000	308,250,000	+12.94
Texas	4	203,320,000	165,485,000	370,811,000	—55.37	3,949,704,000	3,734,603,000	+ 5.76
Utah	4	12,605,000	10,309,000	8,617,000	+19.64	111,032,000	95,210,000	+16.62
Vermont	4	5,715,000	5,038,000	3,884,000	+29.71	49,974,000	41,234,000	+21.20
Virginia	5	35,589,000	40,038,000	36,721,000	+ 9.03	424,326,000	398,962,000	+ 6.36
Washington	5	43,859,000	34,365,000	31,631,000	+ 8.64	379,406,000	345,809,000	+ 9.72
West Virginia	5	23,125,000	16,866,000	14,965,000	+12.70	174,956,000	147,806,000	+18.37
Wisconsin	4	55,682,000	49,429,000	39,616,000	+24.77	533,753,000	449,006,000	+18.87
Wyoming	4	7,851,000	6,978,000	6,883,000	+ 1.38	69,249,000	63,957,000	+ 8.27
Total		2,292,725,000	2,120,325,000	2,045,771,000		24,587,558,000	22,329,870,000	
Daily Average		73,959,000	70,678,000	68,192,000		73,615,000	66,656,000	
Change from previous year:								
Total Change		.....	+74,554,000	.....		+2,257,688,000	.....	
Percentage change in Daily Average		.....	+3.65%	.....		+10.44%	.....	

*These are state tax rates per gallon. In addition there is the federal tax of 1½c per gallon.

CLASSIFIED

For Sale

1941, 4000 gallon Progress, 3 compartment tank and size 450 GMC Tractor with 80% of rubber, air brakes.* All in excellent condition. $3200 at low ceiling. Speedway Oil Co., Anderson, Ind.

FOR SALE: Ford tractor and White WA22 purchased new 1944. 4 Fruehauf tank trailers, 3 compartments, 3950 gallons capacity. Purchased new 1944 and 1945. Will sell all or part. Southeastern Oil, Graham Bldg., Jacksonville, Florida.

FOR SALE: Several used 4000 to 4250 gallon gasoline transports. Excellent condition. Butlers, Fruehaufs, and Standard Steel. Immediate delivery. G. E. Bobbitt, 1209 Insurance Bldg., Raleigh, N. C. Phone: 3-1793.

FOR SALE

GASOLINE, FUEL OIL & PROPANE BULK PLANTS
DESIGNED & ERECTED COMPLETE

WRITE FOR DETAILS OF OUR TIME PAYMENT PLAN

KENNEY TANK INSTALLATION CO.
2132 N. Halsted St.
Chicago 14, Illinois

TRANSPORT TRAILERS

1—5000 gallon three compartment, tandem axle, Fruehauf trailer, 1945 model, like new.

1—4500 gallon three compartment, tandem axle, Fruehauf trailer, 1943 model. Excellent condition.

1—4200 gallon three compartment, single axle, Standard Steel trailer, 1944 model, excellent condition.

1—4000 gallon three compartment, single axle, Fruehauf trailer, 1944 model, excellent condition.

1—3900 gallon three compartment, single axle, 1942 model, Fruehauf trailer, good condition.

Have tractors for above units if desired, will sell tanks individually, or with tractors, priced right. Located in Southern Wisconsin.

BOX 787

TRACTORS-TRAILERS

1 New GMC Tractor Model AC853 1945. This truck has never been driven a mile. Air, 12:00x20 tires, fifth wheel included. $6500.00. This is way below the ceiling price, but will sacrifice.
Also, have 1940 GMC Tractor, Air. Two heavy duty Brockway Tractors vacuum.

1 1939 White Tractor Model 20A, Air

4 Semi-Trailer tanks
All the above equipment has big tires and ready to start work without spending an additional penny. Do not write or wire, but come up to see them and take what you want with you.

WILLIAM A. EVANS
75-79 Fillmore Ave., Buffalo 10, N. Y.

For Sale

ALWAYS GET ISP's QUOTATIONS TOO!
USED TANK CAR TANKS
For Liquid Storage
6000 to 10,000 gallons
HEAVIER SAFER CHEAPER
CLEANED TESTED
PAINTED
Also, Vertical Tanks of All Capacities
IRON & STEEL PRODUCTS, INC.
41 years' experience
13456-A S. Brainard Avenue
Chicago 33, Illinois
"ANYTHING containing IRON or STEEL"

For Sale

TRUCKS-TANKS

Six ton Mack coal truck, hoist body.
Five ton Mack coal truck, hoist body.
1520 gallon fuel oil truck Auto-Car complete.
1520 gallon truck tank, with accessories.
1540 gallon truck tank, with accessories.

GRAMATAN
FUEL AND SUPPLY CORP.
45 Kraft Ave. Bronxville 8, N. Y.

VALVES FOR HF ACID AND HCL SERVICE

1 New 3" Merco Valve R-31 # 2045
2 New 3" Merco Valves #2045 MW2 Special 300# Flanged Hyperseal-Valve RF for Isom Service
21 New 4" Merco Valves #2045 MB Cast-Steel Flanged Hyperseal Valves Modified for HF Service
4 New 3" Merco Valves #2244 Screw 600# Hyperseal Plug Valve
11 New 6" Merco Valves #2049 MB10 Special
3 New 8" Merco Valves #2049
4 New 1" Reed Special Valve—#R21c174mk
2 New 1½" Reed Special Valve—#R21c174mk
4 New 2" Merco Valves #2045
10 New 2" Merco Valves #2045 MB5 Special
2 New 3" Merco Valves #2045
10 New 4" Merco Valves #2045MB 10 Special
2 New 8" Merco Valves #2049 Special
6 Used 8" Fig. #2049 Relined
2 Used 6" Fig. #2045 Relined
7 Used 6" Fig. #2049 Relined
1 Used 6" Fig. #2049 Relined without Gear
14 Used 4" Fig. #2045 Relined
9 Used 3" Fig. #2045 Relined
7 Used 2" Fig. #2045 Relined
2 Used 1½" Fig. #2045 Relined
1 Used 1½" Fig. #2245 Relined
6 Used 1½" Fig. #2244 Relined
1 New 2½" Fig. #2245
1 New 2½" Fig. #2245WL MB11
2 New 2" Fig. #2245W MW2 & MB11
1 New 1½" Fig. #2245
3 New 3" Fig. #2045 MB11
1 New 3" Fig. #2025WL MW1
5 New 3" Fig. #29225MA-3
3 New 2" Fig. #2025WL MB-11
24 New 2" Fig. #29225MA-4
3 New 1½" Fig. #29225MA MA-4
10 New Merchrome Coated Lubricated 3" Plug Valve, Fig. No. 2045-MB-5 w/Ring Joint Facing
1 Used 1½" Fig. 2245 Merco Plug Valve Relined
2 Used 2" Fig. 2045 300# Merco Plug Valve Relined
5 2" Fig. 2045 300# Merco Hyperseal Valves Relined, Used

MISCELLANEOUS VALVES

1 Used Chapman Gate Valve 3" RTJ for R-31
2 Used Crane Valves 2" C.I. Bronze Trim Wedge Gate, O S & Y, F & D, 125#
1 New Crane Valve 2½" C.I. Bronze Trim Wedge Gate, O S & Y, F & D, 125#
2 New Crane Valves 3" C.I. Bronze Trim Globe, O S & Y, 125#
3 New Crane Valves 4" Cast Steel Flange Globe, F & D, 150#
1 New Crane Valve 6" Cast Steel Flange Globe, F & D, 300#
4 New Crane Valves 6" Cast Steel Flange Globe, F & D 150#
2 New Crane Valves 8" Cast Steel Flange Globe, F & D, 150#
234 New Merco Valves ½" Fig. #2244
3 Used Merco Valves ¾" Fig. #2244½
1 New Merco Valve 1" Fig. #2244½
3 New Merco Valves 1" Fig. #6404 SA-38
1 New Powell Globe Valve 6" Fig. #1531
132 Used Merco Valves ½" Fig. #2244
1 Used Merco Valve 8" Fig. 1989, Gear
2 Used Merco Valves 6" Fig. #4289
1 Used Merco Valve 6" Fig. #2025
16 Used Merco Valves 3" Fig. #2029
2 Used Merco Valves 2" Fig. #1925
2 Used Merco Valves 2" Fig. #2025
3 Used Merco Valves 3" Fig. #1925
3 Used Merco Valves 4" Fig. #2025
2 Used Merco Valves 2" Fig. #2045
1 Used Merco Valve 1½" Fig. #2045 Hyperseal
1 Used Merco Valve 2" Cat. #330E, 600# Gate Valve
2 Used Merco Valves, Threaded 4" (1 Crane & 1 Kelly) 125# Gate Valve
5 Used Merco Valves 6" 2025, 4289
3 Used Merco Plug Valves 2" Fig. #115
1 Used Merco Valve 4", 2025
2 Used Merco Valves 3", 2025
2 Used Crane Valves 2", #125 C.I. Flanged Gate
1 Used Crane Valve 3", #125 C.I. Flanged Gate
1 Used Crane Valve 3", #125 C.I. Flanged Globe
3 Used Crane Valves 3" O S & Y Globe Stainless Steel, F & D
20 Used Crane Valves ½" Monel Trim, Screw Globe
6 Used Crane Valves ½" Monel Trim, Screw Globe

CHEMICALS & CATALYSTS

2200 Lbs. Calcium Chloride—Good Condition
375 Lbs. Fluorite Desiccant—Good Condition
300 Lbs. Sodium Bicarbonate—Good Condition
100 Lbs. Soda Ash—Good Condition
1820 Lbs. Aqua Ammonia,—Excellent Condition
1000 Lbs. Diethylene Glycol—Excellent Condition
230 Gals. Chlorinated Rubber Paint—Excellent Condition
1760 Lbs. Phosphoric Acid—Excellent Condition
700 Lbs. Drierite—Excellent Condition
16.5 Tons Porocel, 12/20 Mesh, 2% V.M.—Fair Condition
30 Tons Porocel, 12/20 Mesh, 2% V.M., Low Silica—Excellent Condition
40.6 Tons Porocel, 4/10 Mesh 2% V.M., Low Silica—Excellent Condition
99,550 Lbs. Aluminum Chloride—Poor Condition
5,000 Lbs. Anhydrous Hydrogen Chloride—Excellent Condition
123,106 Lbs. Hydrofluoric—Excellent Condition

Items listed herein may be inspected at Enid, Oklahoma. Bids acceptable on all or any part of the above listed items and must be received not less than 20 days from the date of this issue.

Items listed herein may be inspected at Enid, Oklahoma. Bids acceptable on all or any part of the above listed items and must be received not less than 20 days from the date of this issue.

CHAMPLIN REFINING COMPANY
Enid, Okla.

CLASSIFIED

For Sale

SEMI-TRAILER

Semi-Trailer, streamlined, made by Farrell, 1687 Gallons, 5 compartments, good tires. Ideal for city deliveries. Priced at $825.00.

INDEPENDENT PUMP COMPANY
535 Ottawa St. Muskegon, Mich.

TRACTOR-TRAILER

Two-ton Dodge tractor, 3015 gallon tank, Fruehauf semi-trailer with 2½" meter. Excellent condition, fully equipped, all necessary accessories, ready for use. $2600.00.

P. O. BOX 167
Charles Town, W. Va.

TRACTOR-TRAILER

Three-ton Dodge tractor, 3400 gallon two-compartment tank, Great Dane semi-trailer. Excellent condition, fully equipped, all necessary accessories, ready for use. $3100.00.

P. O. BOX 167
Charles Town, W. Va.

Wanted to Buy

WANTED: 5 compartment, 3000 gallon tank in good condition suitable for straight tandem axle truck. Acme Oil Company, Box 158, Schenectady, N. Y.

WANTED—Gasoline transport, 3 or more compartments, not over 3200 gallons. Must be in good condition and suitable for installation of skirting and meters. Tank to be used as city delivery unit. Write P. O. Box 48, Little Rock, Arkansas.

WANTED—Light oil tank truck, good condition, cab over engine preferred, three or four compartments, capacity about 1200. Please advise details including price. Wells Petroleum Company, 800 Haines St., Chicago 22, Ill.

WANTED

Self-propelled diesel engine steel oil barge, app. 5000 barrel capacity. Must be in first class condition for operation on Atlantic Coast, New England District. Beam not over 34 feet. Reply

Box 785

WANTED TO BUY

Steel Storage Tanks any size. Preferably horizontal. Also Viking pumps.

EMPIRE EQUIPMENT CORPORATION
608 Empire Bldg. Cleveland 14, Ohio
Phone: Main 7667

For Lease

TO LEASE

River terminal liquid storage facilities located just west of Chicago city limits. River and Santa Fe railroad transportation. Will build to suit single or battery storage tanks.

MR. J. L. STONE
BULK SERVICE STATIONS, INC.
2958 N. Ashland Ave., Chicago 13, Ill.
Phone: Wellington 7600

Position Wanted

MARKETER: Experienced in all phases of sales, transportation and distribution. Interested in position of responsibility. Box 783.

REFINERY SUPERINTENDENT, chief chemist, Industrial Sales manager, 26 years experience, salary reasonable. Would consider profit sharing arrangement. Box 776.

CONSTRUCTION ENGINEER seeks affiliation with an oil company having in mind a postwar station building program. The advertiser has had 18 years construction and engineering, age 41, with considerable experience in the design and actual construction of modern service stations. Recently released from the army. Box 777.

VETERAN, 32, will trade 6 years oil company experience and a lot of hard work for job with future. Married, two years college, one year business school, special personnel management training. Was assistant bulk plant manager large oil company prewar. Want office or sales work, D. H. Finley, 4373 Laclede Ave., St. Louis, Mo.

EXPERIENCED OIL MAN recently discharged from the U. S. Navy desires connection as jobber or distributor salesman in Indiana and Ohio. Presently employed as salesman in the oil business but desirous of increasing present income. Can furnish best of references as to sales and operating ability. Have own car in good condition. Excellent health and education. Box 778.

EXECUTIVE ASSISTANT to controller or industrial relations manager. Now employed major oil company. Have 11 years oil company experience in accounting, personnel, executive staff assistant capacities. Age 36. College educated with masters degree economics. Desire make change anywhere United States preferably Midwest. Minimum salary $5,000.00. Box 789.

EUROPEAN REPRESENTATIVE

HOLLANDER, Linguist, oilman, visited all oil and wax dealers in Europe, can sell all petroleum products, seeks representation. Can also buy large quantities own account against L/C.

J. FABER
132 Acasiastraat The Hague, Holland

STRENGTHEN YOUR MARKETING

SALES EXECUTIVE AVAILABLE

Strengthen your marketing position—improve to-morrow's sales and profits by engaging this capable sales executive. Broad, practical experience, dating from High School in selling, sales management, merchandising, sales promotion, sales training and market analysis at all levels of distribution in the automotive and Petroleum fields. Have Law Degree, coupled with experience in selection, leasing and purchasing of real estate for bulk plants and service stations—experience in buying out small marketing companies.

Can plan and execute strong marketing program—ability to select, train and motivate sales force. Interesting and forceful speaker—author of practical productive sales articles and presentations.

A leader with initiative, drive, sound judgement. Unquestionable integrity, with knowledge of sales organization and administration problems. Presently employed as sales manager of integrated Oil Company. Desires position with unlimited possibilities. Age 38, happily married. Best references. Evidence of ability, accomplishments and character available. Salary $12,000. plus bonus.

Box 786
National Petroleum News.

Situations Open

SALES MANAGER

Manager of sales for Chemical Company specializing in petroleum chemicals such as rust preventatives and oil additives. Technical training desirable but not necessary. Contact by letter only, giving full details of experience, age and other information helpful in judging your qualifications.

NOX-RUST CHEMICAL CORPORATION
24-29 S. Halsted St. Chicago 8, Ill.

MANAGER

Executive capable of assuming full managerial responsibility in old established petroleum distributing business with chain of first-class service stations Chicago area. Must be thoroughly experienced in this business with highly successful record. Substantial salary and profit sharing. State complete qualifications in first letter. Replies confidential. Our employees know of this ad.

BOX 788

MECHANICAL ENGINEER

Technical graduate preferred, experienced in over-all refinery maintenance and repair of crude distillation units, thermal and catalytic cracking units, alkylation, absorption, fractionation, lube, asphalt, and high-pressure steam-boiler plants. Thorough knowledge of exchangers, pumps, turbines, compressors, pressure vessels, and piping and welding procedures. Give complete history of previous and present connections, age, education, experience, references, and minimum salary expected. Permanent position with major oil company located in Southern California.

Box 784

Professional Service

ANTI-KNOCK VALUES DETERMINATORS
The Gray Industrial Laboratories
Chemists and Engineers
Specialists on Petroleum Products
961-976 Frelinghuysen Ave.,
NEWARK, N. J.
Telephone Bigelow 3-4020

Classified Rates

"For Sale," "Wanted to Buy," "Help Wanted," "Business Opportunities," "Miscellaneous" classifications, set in type this size without border—15 cents a word. Minimum charge, $4.00 per insertion.

"Position Wanted"—10 cents a word. Minimum charge $1.50 per insertion.

Advertisements set in special type or with border—$5.00 per column inch.

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ABOUT OIL PEOPLE

After nearly four years as chief of the Forest and Mineral Products Section of Supply and Resources Service of FEA, **H. W. Straley III,** chairman of the AIME committee on geophysical education, has retired from government. He has opened consulting offices in Washington where he will specialize in exploration of mining and oil properties in the Appalachian, Atlantic Coastal and Caribbean regions.

° ° °

Guy F. Evered has joined Maritime Petroleum Corp., New York, as comptroller and treasurer, filling the vacancy created by the resignation of **N. E. Bonnell.** Since his discharge from the Navy, Mr. Evered has been vice president and trust officer of Rye Trust Co. He joined Maritime March 1.

° ° °

A. B., "Al" Nichols, home office service division manager for Standard Oil Co. (Ohio), is convalescing in Arizona following his recent discharge from a Cleveland hospital. Mr. Nichols for many years has been director of entertainment at convention banquets of the Ohio Petroleum Marketers Assn. The association's convention on March 12-14 will be the first one since the association was founded 24 years ago at which Mr. Nichols has not been "master of ceremonies."

° ° °

Campbell Osborn, recently a member of the Board of Appeals representing industry in the War Production Board, has opened offices in Washington, D. C., and Lucketts, Va., to represent industry before the federal departments and independent agencies.

Mr. Osborn, who for a time was executive officer of the Chemicals Division in the WPB, will specialize in production, price and labor problems. His Washington office is located in the Woodward Building, and his Lucketts, Va., location is Rt. 1.

° ° °

James O. Lewis, Dunn & Lewis, Houston, was named Anthony F. Lucas Medalist, 1946, at the American Institute of Mining and Metallurgical Engineers convention in Chicago Feb. 27. An outstanding pioneer in the science of petroleum engineering, Mr. Lewis has a varied oil industry career. For six years he performed geological and petroleum engineering work for Associated Oil Co. and other private interests in California, Texas, Montana and Canada. In 1915 he joined the Bureau of Mines as chief engineer of the Petroleum and Natural Gas Division. He left the bureau in 1920 to engage in consulting work with Dunn & Lewis.

S. A. Montgomery, manager, Whiting, Ind., refinery of Standard Oil Co. (Indiana), will be promoted to assistant general manager of manufacturing, Chicago general office, on March 11. Mr. Montgomery joined Standard in 1919 as chemist at Wood River plant and was made Whiting manager in 1942. **Dr. W. J. McGill,** manager of Standard's Wood River, Ill., plant, will succeed Mr. Montgomery as Whiting manager. He also joined company as a chemist, but in 1924.

° ° °

Recent visitor to NPN's editorial offices in Cleveland was **Lymon B. Veeder,** retail merchandising representative for Shell Oil Co., New York. Mr. Veeder is on a special mission covering the Eastern United States in a study of postwar lubricants.

° ° °

Markley Named Sun Sales Mgr.

Special to NPN

PHILADELPHIA — Frank R. Markley has been made general sales manager of Sun Oil Co. Formerly manager of the company's industrial products department, Mr. Markley will serve as assistant to Samuel B. Eckert, vice president in charge of marketing.

Maximillian H. Lester is new general manager of Sun's motor products department and Ray H. Anders has been appointed to succeed Mr. Markley.

° ° °

Named Assistant to Gen. Mgr. Of Colonial Esso Marketing

NEW YORK — Alan R. Martin has been appointed assistant to general manager of marketing of Colonial Esso Marketers, a newly-created position. In his new office Mr. Martin will deal with general marketing matters throughout the Colonial Esso Marketers territory in 18 states and the district of Columbia.

Mr. Martin

Mr. Martin joined Standard Oil Co. of New Jersey 19 years ago as one of the staff of the personnel office at the Bayonne Refinery, Bayonne, N. J. In 1929 he was transferred to company headquarters as assistant in personnel and training. He later became special representative for the sales department and in 1936 was named head of its personnel and training unit.

In November, 1944, Mr. Martin was named assistant manager of the employe relations department.

ABOUT OIL PEOPLE

James W. Perkins has been named vice president and general manager of Petroleum Facilities, Inc., Nashville, Tenn.

° ° °

R. L. Kidd and **Frank M. Perry,** Bartlesville, have been elected to the board of directors of Cities Service Oil Co. (Del.).

Mr. Kidd, who is manager of the company's land and geological division, has been with the company nearly 21 years. He has served as resident geologist at Oil Hill, Kans., for Cities Service Gas Co., chief geophysicist for Cities Service Oil Co., assistant chief geologist, chief geologist of the Bartlesville division and manager of the land and geological division.

Mr. Perry is manager of the natural gasoline and chemical division. He was first employed by a Cities Service company in 1919, shortly after graduating from Mississippi State College. He was plant manager of General Atlas Carbon Co., Pampa, Texas, for 18 years prior to his appointment to the managership of Cities Service Oil Co.'s natural gasoline and chemical division.

° ° °

Among out of state visitors attending the Kentucky Petroleum Marketers Assn. convention in Louisville on Feb. 19-20 was **Charles J. Sanders,** commission agent and terminal superintendent for Lion Oil Refining Co. at Nashville, Tenn.

° ° °

Judge William H. Zwick, after nearly 20 years of association with Continental Oil Co., has retired

Judge Zwick joined Continental Aug. 1, 1926, and has held the position of general attorney for several years. He studied law at the University of Kansas, and then went to Oklahoma City where he practiced for many years before being appointed assistant attorney general of Oklahoma. Later he was elected district judge for Oklahoma County, and resigned from the bench to become associated with Continental. He has moved from Ponca City to Oklahoma City to make his home.

° ° °

J. Pickens Coleman, oil operator, has been elected president of North Texas Oil and Gas Assn. at a meeting of the board of directors in Wichita Falls, Tex. He succeeds **Ed G. Kadane. E. (Gene) B. Clark** was elected vice president and **Fred Sechmann** retained the office of executive vice president.

° ° °

U. R. Laves, formerly head of the industrial machinery division of OPA in Dallas, has been added to the staff of American Petroleum Institute as administrative assistant in the production division, with headquarters in Dallas.

° ° °

Harry A. Birch, Jr., formerly with Ashland Oil & Refining Co., has become a partner in his own company, Vogel, Birch & Co., for the sale of oil supplies, household equipment for the service station trade, and a general line of oil marketing equipment. Headquarters of the new company is in Ashland.

° ° °

J. Sales Leach, vice president of The Texas Co., has been added to the board of trustees of Hermann Hospital Estate in Houston. He is also a member of the board of trustees of Baylor University and Baylor Medical College.

° ° °

John W. House of Midland, Tex., has been named acting chairman of a group in Midland planning to organize and operate a Midland Petroleum Club, which would occupy an entire floor of a proposed new $750,000 office building.

° ° °

Robert S. Brennand, Jr., has resigned as Permian Basin landman for Standard Oil Co. of Texas. He has been stationed at Midland, Tex.

° ° °

B. F. Daily, Big Lake, Tex., senior inspector for Shell Pipe Line Corp., has been named West Texas construction supervisor for the company, succeeding **E. O. Kemper,** who has resigned.

° ° °

Name McCabe General Sales Manager of Tide Water's Eastern Division

NPN News Bureau

NEW YORK — Eugene F. McCabe has been appointed general sales manager of the Eastern Division of Tide Water Associated Oil Co.

In addition to Mr. McCabe's appointment to the vacancy occasioned by the resignation Dec. 31, 1945, because of ill health, of R. E. Ryerson, three new assistant general sales managers were named from within the company's ranks and new sales department heads were appointed for New England and New York territories.

New assistant general sales managers are: R. D. Rogers, William S, Whelan and Dartley E. Hoffman, who, with Dr. L. W. Parsons, export sales manager, will serve as members of the eastern sales committee under the chairmanship of Mr. McCabe.

Mr. McCabe has been with the marketing department of Tide Water for 24 years. He has served as chairman or member of many committees in the petroleum industry and in 1945 was chairman of New York State Petroleum Industry Committee and vice chairman of New York State Industry Rubber Drive. In his new post he will have charge of Tide Water's entire sales operations in the Eastern Division.

Mr. McCabe

Mr. Rogers

Mr. Hoffman

Mr. Whelan

Mr. Rogers joined Tide Water in 1920 at Tulsa and was transferred to the Eastern Division in 1925, being general superintendent of the Bayonne refinery until 1933 when he was made manager of operations of the eastern sales department.

Mr. Whelan's first connection with the company was as a salesman in the New Jersey area in 1922. He rose to the position of sales manager of the company's former eastern department and in 1926 was promoted to manager of the New England department.

Mr. Hoffman joined the company at the Boston office in 1914 as a junior clerk, advancing steadily until he became manager of wholesale domestic and foreign sales of lubricants. In his new position he will continue in that field.

Formerly manager of sales of automobile accessories, Frank J. Weess has been placed in charge of the New England territory with headquarters in Boston. His place as accessory sales manager will be filled by Charles G. Sloan, Jr., formerly sales manager in charge of the New York metropolitan department.

Rush F. Carrier, formerly sales manager for northern New York State territory, has been promoted to sales manager for all of New York State, including New York City.

ABOUT OIL PEOPLE

From assistant manager of the specialty department to district manager of the Little Rock, Ark., district, of Gulf Refining Co.—that's a condensed version of the oil career of **L. Philip Magee.**

Mr. Magee

But there's more to it than appears on the surface. Mr. Magee is now chairman of the Oil Dealers' Assn. of Arkansas, an indication that the more than 500 convention registrants last December shared a pretty fair respect for his ability as a leader and his understanding of the problems of Arkansas oil men.

Mr. Magee began his oil career with Gulf Refining Co. in New Orleans in February, 1934, as assistant manager of the specialty department, as noted above. In 1935, assuming the capacity of supervisor of specialty sales, he continued in that position until January, 1938. At that time, he relates, he visited all Gulf salaried points throughout the New Orleans division merely seeking information and further experience in the oil business. In March, April and May of that year he was put through a rigid training course.

Following his period of training, Mr. Magee was assigned the position of field supervisor with headquarters in Little Rock, Ark., and retained this post until July, 1940, at which time he was appointed agent at Memphis, Tenn.

Mr. Magee remained in Memphis until May of 1943 when he was made division merchandising and advertising manager with headquarters in New Orleans.

Dec. 1, 1944, came around as moving day again. This time returning to Little Rock as district manager, the position Mr. Magee holds now.

Born in Mississippi, Mr. Magee moved to New Orleans in 1919, residing there until 1938.

He is a member of Kiwanis International, Masons, Shriners, Little Rock Country Club, Chamber of Commerce and the Sales Managers Council.

° ° °

Dick Wotowitch, veteran oil and grease man from Philadelphia, reports that he is making headway after having to go to the hospital when he was hit by an automobile that in turn had been hit by a trolley car last December. Dick got rather well banged up and it laid him out, but after a week in the hospital, he has been home letting his bones knit.

Fred L. Whitely, after 22 years with National Refining Co., as sales manager at St. Louis, organized the Whitely Oil Co. at Columbia, Mo., and has been operating it for some time. In addition to operating a bulk plant, he is a contract carrier of gasoline with his own fleet of trucks.

° ° °

Dr. Miller Retires From Conoco, H. G. Osborn Assumes Duties

Special to NPN

PONCA CITY, Okla. — Dr. Walter Miller, vice president in charge of manufacturing, Continental Oil Co., has retired. Harold G. Osborn, manager of manufacturing, will assume full charge of the company's eight refineries.

A native of Switzerland, Dr. Miller came to this country when he was a small boy. For several years after completing his elementary school education he worked at various jobs, among them blacksmith's helper, before joining Tide Water Oil Co. as yield clerk at the Bayonne, N. J., refinery in 1909. While there he reached the position of process superintendent and then resigned to join Pierce Refg. Co., Tulsa, as general superintendent of three refineries.

During the latter part of 1921 he did consulting refining work for Marland Oil Co., and the following year took full charge of the company's refining operations. When Marland and Continental merged in 1929 Dr. Miller continued as vice president in charge of manufacturing.

In 1943, he was awarded an honorary degree of Doctor of Engineering by the University of Tulsa.

Dr. Miller will continue active work in the industry by devoting his time to consulting work in refinery processing.

° ° °

Promoted by Socony-Vacuum

NPN News Bureau

NEW YORK—George D. McDaniel, for the past 15 months district sales manager for Socony-Vacuum Oil Co., Inc., in Baltimore, has been named Southeastern Division manager. He succeeds George Walker, who has been transferred to New York to become head of Socony-Vacuum's national planned distribution survey department.

Mr. McDaniel

W. H. Stanford, district sales manager, Springfield, Mass., has been named to suceed Mr. McDaniel.

COMING MEETINGS

MARCH

Kansas Oil Men's Assn., annual convention, Broadview Hotel, Wichita, March 11-12.

Ohio Petroleum Marketers Assn., annual convention and trade exposition, Hotel Deshler-Wallick, Columbus, O., March 12-14.

Indiana Independent Petroleum Assn., spring convention, Hotel Severin, Indianapolis, Ind., March 14-15.

Western Petroleum Refiners Assn., 34th annual meeting, Blackstone Hotel, Fort Worth, Texas, March 25-26-27.

APRIL

American Petroleum Institute, Marketing Committee, Atlanta, Ga., April 2.

Society of Automotive Engineers, Aeronautic (Spring) meeting, Hotel New Yorker, New York, April 3-5.

Empire State Petroleum Assn., Inc., annual convention, Hotel Mark Twain, Elmira, N. Y., April 10-11.

Society of Automotive Engineers, Southern California section, diesel engineering meeting, Biltmore Hotel, Los Angeles, April 5.

Independent Oil Men's Assn. of New England, convention at Statler Hotel, Boston, Mass., April 11-12.

American Petroleum Institute, Production Division, Biltmore Hotel, Los Angeles, April 11-12.

Interstate Oil Compact Commission, spring meeting, Tulsa, April 11-13.

Eastern Petroleum Credit Group, 9th annual conference, Copley Plaza Hotel, Boston, April 15-16.

Natural Gasoline Assn. of America, annual convention, Baker Hotel, Dallas, Texas, April 17-18-19, 1946.

National Petroleum Assn., Hotel Cleveland, Cleveland, O., April 18-19, 1946.

Michigan Petroleum Assn., spring convention and trade exhibit, Leland Hotel, Detroit, April 23-24.

National Oil Heat Exposition, sponsored by Oil-Heat Institute of America, Inc., Philadelphia, April 23-27.

Independent Petroleum Assn. of America, mid-year meeting, Houston, Tex., April 29, 30 and May 1.

MAY

National Association of Corrosion Engineers, President Hotel, Kansas City, May 7, 8, and 9.

National Oil Scouts & Landsmen's Assn., Hotel Heidelberg, Jackson, Miss., May 23-25, 1946.

American Petroleum Institute, Production Division, Shreveport, La., Washington-Youree Hotel, May 17-18.

JUNE

Society of Automotive Engineers, Summer (Semi-Annual) Meeting, Hotel French Lick Springs, French Lick, Ind., June 2-7.

American Petroleum Institute, Production Division, Skirvin Hotel, Oklahoma City, June 6-7.

American Petroleum Institute, Production Division, spring meeting, William Penn Hotel, Pittsburgh, Pa., June 13-14.

Oil Heat Institute of New England, annual exposition, Hotel Statler, Boston, June 24-27.

AUGUST

Society of Automotive Engineers, West Coast Transportation & Maintenance meeting, Hotel New Washington, Seattle, Wash. Aug. 22-24.

SEPTEMBER

Chicago Section, American Chemical Society, Coliseum, Chicago, Sept. 10-14.

Society of Automotive Engineers, Tractor Meeting Hotel Schroeder, Milwaukee, Wis., Sept. 11-12.

National Lubricating Grease Institute, 14th annual meeting, Edgewater Beach Hotel, Chicago, Sept. 29-Oct. 2.

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TECHNOLOGY DEPT.

NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to

REFINERY MANAGEMENT and PETROLEUM CHEMICAL TECHNOLOGY

Section Two | March 6, 1946 | Vol. 38, No. 10

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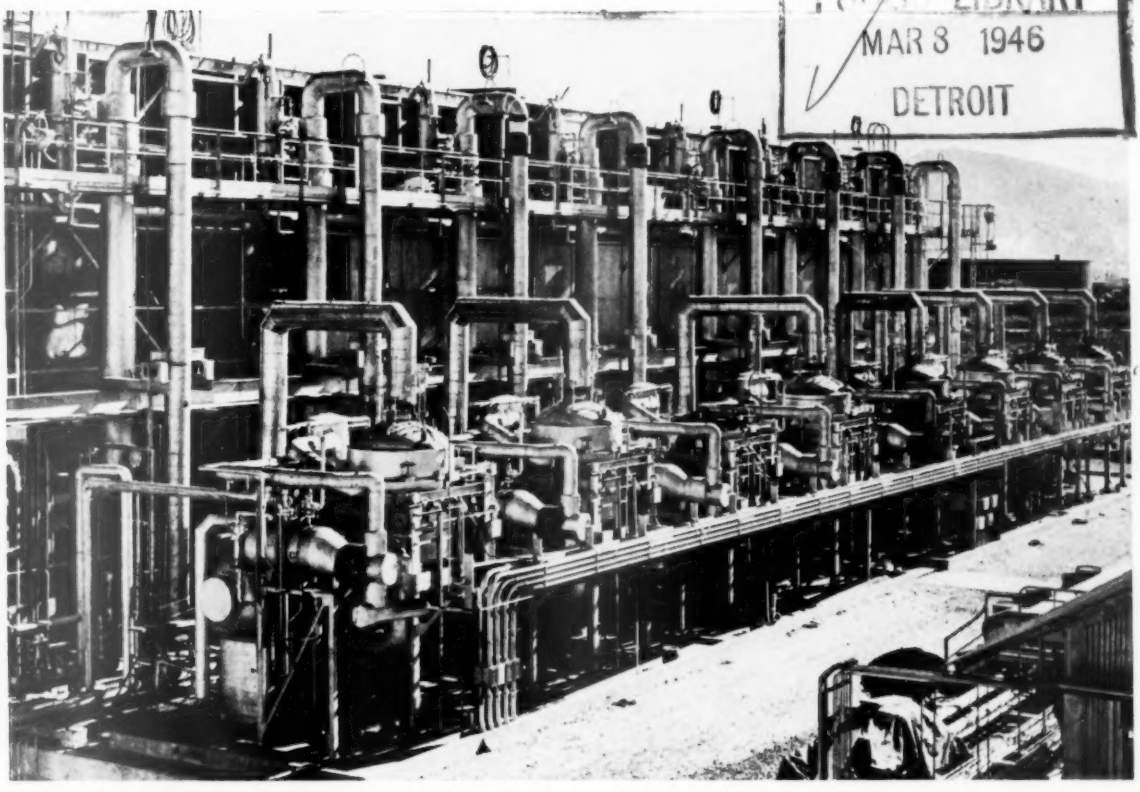

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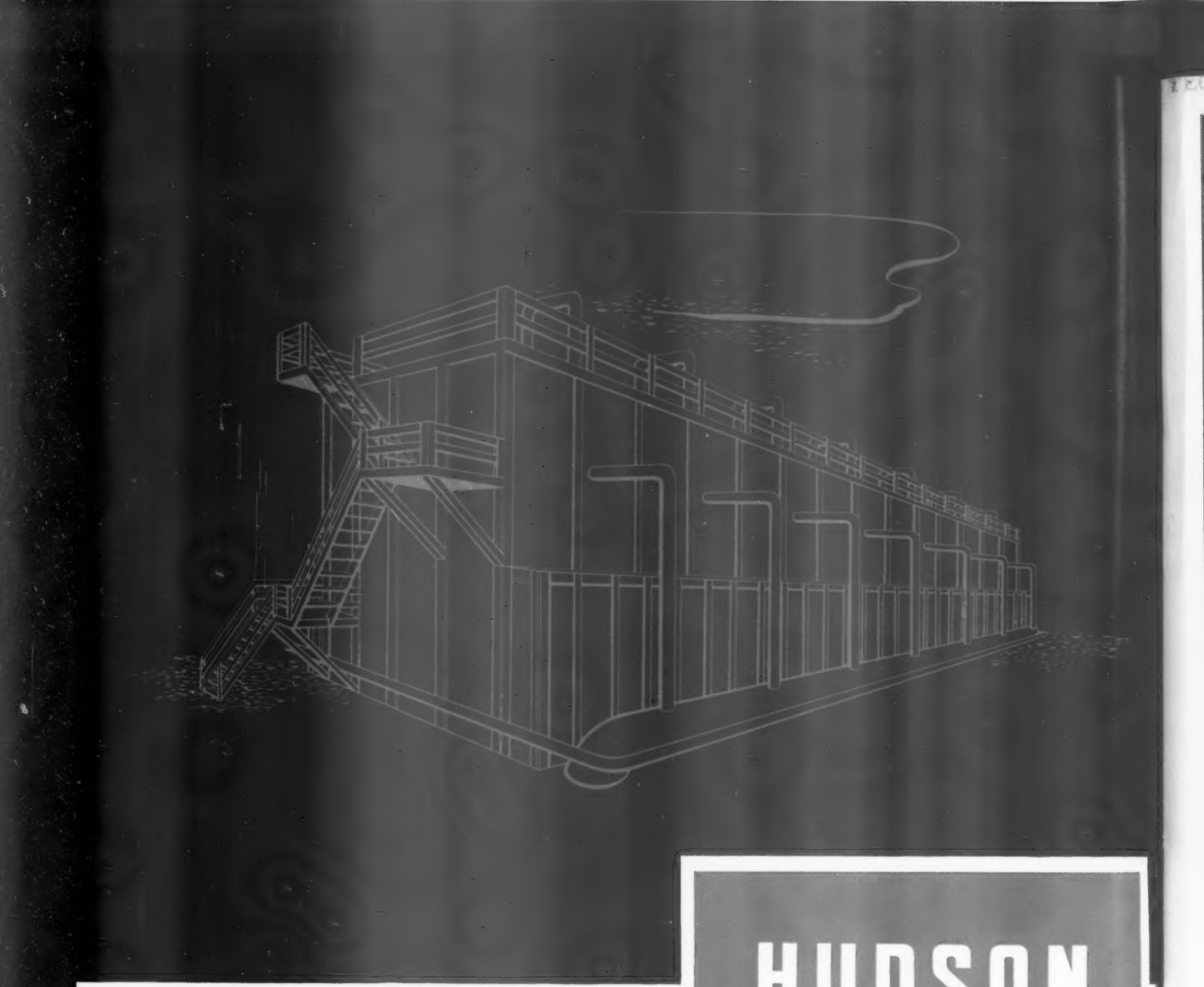

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TECHNOLOGY DEPT.

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NEW SERIES

Six Exclusive Articles by Dr. K. M. Watson and Associates

STARTS IN APRIL

Another important contribution of fundamental design data has been made by the author of the popular series on Process Engineering Data, published in the NPN TECHNICAL SECTION in 1944-45. This new series will find its practical application in the design and construction of modern petroleum processing units.

Principles of Reactor Design

Under this title, the NPN TECHNICAL SECTION will publish Dr. Watson's latest contribution to basic design data in a series of six exclusive articles, beginning in its April 3rd issue.

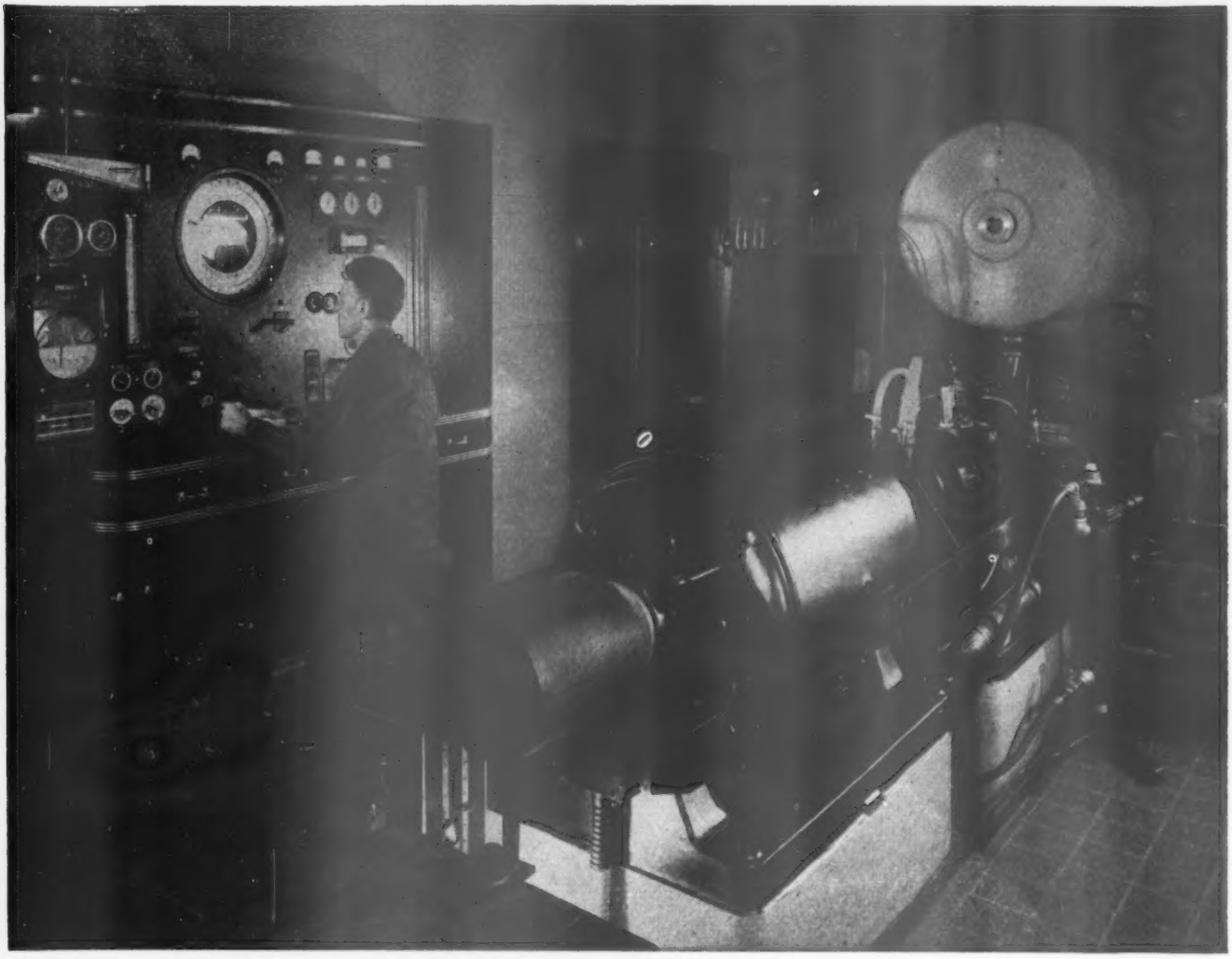
The articles are the result of extensive experimental research programs carried out at the University of Wisconsin, to secure data which could be integrated and applied in the design of commercial reactors and other equipment processing the relatively new type of products used in large volume in the wartime refining program.

Need for determining, compiling and correlating fundamental data on the conversion of hydrocarbons to such products as aromatics, toluene, butane-butene fractions and others was esential to their production in the scale proposed in the wartime program.

The job of securing the required data was assigned to Dr. Watson and his associates at the University of Wisconsin. The results of this important research work have now been released by the government and are being made available to the refining industry in this series of articles. The material will be of practical help in the design, construction and operation of the petroleum refinery units of tomorrow.

The fundamental nature and practical usefulness of the former Watson series on Process Engineering Data created a demand that required a second printing of the series in reprint form. This new series may well prove equally popular.

Watch for the First Article in the April Issue



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REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

Mar. 6, 1946
Volume 38
Number 10

MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

GASOLINE STABILITY

Resistance to Gum Formation In Motor Fuel In Storage Is Studied for the Army

By J. R. Sabina

Important helps to refiners in the control of the tendency of gasolines to form gum in storage are to be found in special tests made by the Gasoline Additives Projects group of the Coordinating Research Council, at the request of the Army Ordnance Department.

The tests covered storage of motor gasolines in cans and in vehicle tanks for 6-month periods where liquid temperatures were around 110°F. The results developed important data on gum tolerance and substantiated previous oxidation stability requirements in Army gasoline.

Other data of value to refiners concerns the type and range of oxidation inhibitors for fuels held under conditions of storage as imposed in the tests. Another conclusion was that copper-sweetened components of motor gasolines should contain, in addition to the anti-oxidant, small proportions of a metal deactivator, as a precaution against deterioration of gasoline stored in vehicle tanks from copper or copper alloys in fuel systems.

BECAUSE of the adequacy of existing controls, the subject of gasoline stability (resistance to gum formation in prolonged storage) and vehicle gum tolerance was of no particular concern to the Coordinating Fuel Research Committee during the years before the war. In fact, the Gasoline Additives Group of the Motor Fuels Division had been wholly inactive during the several years of its existence.

As with many other activities, however, the organizational framework was ready for rapid expansion, and expand it did to meet the wartime requirements of a motorized Army. From the original Gasoline Additives Group, the activity expanded into the Gasoline Additives Projects, dealing with all aspects of motor gasoline stability and the effect of products of oxidation on engine performance. The following comments are a brief review of the activities of these groups of the C.R.C.

In December, 1942, the Additives Group was requested by the Army Ordnance Department to recommend a test, and suitable test limits, for specifying gasoline oxidation stability, so that gasoline would be fit for use in any type of application after six months storage in five-gallon "blitz" cans under the most severe temperature conditions likely to be encountered in any theatre of operation.

The necessity for better control of oxidation was immediately apparent when proposed field conditions became known. Mid-latitude storage in which packages are exposed to direct sunshine, as for example in the North African desert, results in rapid deterioration unless extraordinary stability characteristics are imparted to the gasoline. There is little doubt that there would have been considerable equipment trouble due to gasoline gum had the old specifications been permitted to continue in effect.

A survey of prevailing atmospheric temperatures throughout the world indicated that it would be necessary to stabilize the fuels to withstand liquid temperatures of 110° F. for six months. Because this temperature level was significantly higher than commercial experience, is was necessary for the group to extrapolate beyond available data.

Three months after the request was made, the Additives Group had developed sufficient information to permit the Ordnance Department to incorporate new stability requirements in Specification 2-103 B (see appendix). The important changes were the use of a 7.5-hour induction period determined by a slightly modified ASTM procedure, and the use of only those antioxidants whose efficacy had been demonstrated in commercial applications.

Immediately after submitting the information, the group undertook to verify their conclusions by initiating a storage test at Camp Seeley, Cal. That location was chosen because weather records indicated summer temperatures closely approximating those considered critical.

Some idea of the magnitude of the test may be gained from the following: 41

Acknowledgement

A review of the work of the Gasoline Additives Projects Activities of the Coordinating Research Council was also presented by the same author under the title "Stable Gasoline for War and Peace," before the Metropolitan Section of the Society of Automotive Engineers, New York, Jan. 17, 1946.

J. R. Sabina is technical director of the Petroleum Chemicals Section, E. I. du Pont, de Nemours & Co., Wilmington, Del. Mr. Sabina was director of Gasoline Additives Projects, Motor Fuels Division, Coordinating Fuel Research Committee, CRC, during the period in which the test work on this subject was carried on.

samples of carefully selected gasolines were stored in lacquered and bare iron, rust inhibited, "blitz" cans as well as in a few 55-gallon drums. Such variables as water and venting were also included in the test. The stored samples were inspected at three months and at the end of six months. All samples were initially tested by several accelerated procedures in an attempt to improve on the original recommendation. Parallel laboratory storage tests were also carried out.

The atmospheric temperatures recorded at Camp Seeley during the six storage months averaged 5° to 10° F. higher than predicted, reaching a maximum of 110° F. Gasoline temperatures, on the other hand, were somewhat lower than anticipated, but still within reasonably good agreement with the estimated figure. Based on maximum temperatures it was concluded that the severity of the test adequately met the conditions originally established by Ordnance. It was interesting to note that, while the average gasoline temperature did not quite reach the 110° F. predicted, the overall effect of the desert storage was more severe than the continuous 110° F. laboratory storage of the same samples.

Analysis of the storage data led to several minor modifications and additions to the original conclusions; however, the results indicated that the recommendation was in general satisfactory. The results also led to a second storage series. Patterned after the earlier one, although employing the facilities of Camp Blythe, Cal., instead of Camp Seeley, desert storage tests in cans and drums were conducted on 24 samples of 2-103 B type gasolines.

On the whole the 1944 tests were quite reproducible and free from the uncertainties due to such factors as contamination with rust preventives, and excessive fuel losses from poor containers encountered in the 1943 series. Desert temperatures were somewhat lower than in 1943, tending to moderate fuel degradation. These tests were continued for one year and in a few instances for 18 months; however, no changes were indicated in the conclusions.

The following article, see p. R-166, describes tests in the CRC Gasoline Additives Projects to determine the effect of fuels containing preformed gum on deposits found in vehicle fuel systems.

The outcome of the two desert storage tests, as well as substantiating laboratory tests, led to the following conclusions for the stabilization of 2-103 B gasoline to meet the conditions of storage imposed by the Ordnance Department:

1. A minimum induction period of 480 minutes by the ATSM Method.

2. A maximum of 4 mg. ASTM gum in new gasolines.

3. Gasoline antioxidant concentration, 5 to 35 lbs. active ingredient per 1000 bbls. of gasoline. The lower limit was found necessary to prevent tetraethyl lead precipitation from certain types of fuels, whereas the maximum limit was suggested to prevent unnecessarily high concentrations in the gasolines.

4. Antioxidants should be limited to those commercial products upon which considerable background was already available.

5. Copper sweetened components of 2-103 B gasoline should contain from 1 to 3 lbs of metal deactivator per 1000 bbls. as a precautionary measure, in addition to the antioxidant.

It was extremely gratifying to know from data supplied by the Ordnance Department that gumming troubles were non-existent in Army equipment when operated on gasolines meeting the recommendations of the Additives Group.

Another phase of the gasoline stabilization problem was that dealing with gasoline contained in tanks of vehicles to be held in parking corrals for periods up to six months.

In this application it was necessary to consider the effect of catalytic metals on gasoline stability in addition to the inherent instability of the fuel itself. Based on experience within the group, a recommendation was made for the addition in the field of a concentrate consisting of antioxidant and metal deactivor.

With the assistance of the Ordnance Department a series of vehicle storage tests was carried out in Detroit to investigate the validity of the recommendations.

Twelve used Army vehicles were stored for six months containing Army 2-114 (see appendix) gasoline as received, and after treatment according to the recommendation. Twelve new vehicles were also stored for the same period with gasoline meeting 2-116 (see appendix) specification with a 390-min. induction period. Metal deactivator was added to half the latter units.

No significant amount of gum was formed in any of the gasolines stored in the used vehicles, and the fuel systems of all units were free from deposits. In new jeeps, 2-116 gasoline containing no treatment formed excessive amounts of gum and the carburetor strainer and fuel pump were coated with a thick deposit. No significant gum was formed in the other new vehicles either with treated or untreated gasolines.

The presence of copper or copper alloys in fuel systems is a definite contributor to rapid deterioration of gasolines during vehicle storage. It was recommended to Ordnance that the use of this metal be eliminated from fuel systems whenever possible.

The recommendations for stabilization of gasoline were all predicated on a maximum ASTM gum content of 7 mg. after 6 months storage, and experience demonstrated that the gasolines meeting those requirements would not exceed that limit. However, gasolines shipped to various parts of the world before adoption of the 2-103 B specification in all likelihood would exceed the 7 mg. level and, therefore, probably lead to difficulties.

In an attempt to forestall trouble, recommendations were made to the Ordnance Department relative to the disposition of gasolines containing more than the maximum allowable gum content of 7 mg. Here again the recommendations were based on fragmentary civilian data, since by virtue of good refining practices in this country, gum seldom if ever reached dangerous levels. The opinion was generally held that, while the 7 mg. was a safe figure, it would be possible to appreciably increase it without detrimental effects. Accordingly, several gum levels were suggested, related to specific types of operations.

Again, because of the lack of information in this field, it was believed desirable to carry out a series of controlled field trials in the type of equipment which would use 2-103 B gasoline. Late in 1944 the Army made available facilities for

Fuel storage and loading racks at the Army's Camp Bullis, Texas, where part of the tests on high gum content gasoline were carried out

carrying out such a test at Camp Bullis, Texas.

The first program involved 13 pieces of equipment, which included four ¼ ton 4 x 4 trucks, five 2½ ton 6 x 6 trucks and four M-24 Light Tanks. These vehicles were operated in groups on gasolines containing 1.5, 10 and 21 mg. of gum and 35 lbs. of antioxidant per 1000 bbls. of gasoline.

The outcome of this work led to the conclusion that, at ambient temperatures below 70° F., the M-24 Light Tanks and the two types of trucks referred to would operate for 100 road hours and 5000 miles respectively without difficulty on any of the test gasolines. This result was quite unexpected, the high gum tolerance being attributed to rather low atmospheric temperatures and the relatively short periods of operation. Because of these uncertainties a second and more comprehensive series of tests was inaugurated and carried through at the same locale during May and June, 1945.

The vehicles used in the second test numbered 36, 23 being trucks ranging from ¼ to 4 tons and 13 being light and medium tanks and motorized gun carriages. Eight gasolines were used ranging in gum content from 1.5 to 50 mg. Gasoline antioxidant types and concentrations were also varied to investigate the effect of high concentrations of those compounds on engine condition. The tetraethyl lead content of the gasoline was 3 cc. per gallon. The wheeled vehicles were operated for approximately 10,000 miles while the armored vehicles averaged 2900 miles, totaling approximately a quarter million road miles.

Of the 36 vehicles employed, 32 finished the test without serious difficulty. The four vehicles which encountered trouble operated on gasolines containing 20 mg. or more of gum. Two wheeled vehicles failed before completion of the test due to valve trouble resulting from accumulation of gum deposits in the intake ports. Two light tanks, although finishing the test, experienced difficulty with sticking automatic chokes, which in turn presumably caused faulty hydramatic transmission operation.

The conclusions drawn from the 1945 gum tolerance tests may be summarized as follows:

1—Aged gasoline containing less than 7 mg. ASTM gum is satisfactory for continuous use in all Ordnance vehicles:

2—Gasoline containing between 7 and 50 mg. ASTM gum be used in wheeled vehicles for short periods, but should not be used continuously for longer than 5000 miles. Track laying vehicles should not exceed 150 hours of operation on gasolines within this range. Those vehicles equipped with vacuum operated hydramatic transmissions should be operated only on gasoline containing less than 7 mg. of gum.

3—From the standpoint only of precipitation of antioxidants in the induction system of engines, the trialkyl phenols and para-phenylene-diamine type compounds were satisfactory at the maximum concentrates (35 lbs. per 1000 bbls. of gasoline) permitted in Ordnance 2-103 B gasoline. The aminophenol materials when used at maximum concentrations in gasolines of low antioxidant solubility will probably result in sufficient induction system deposits to give rise to faulty engine operation after prolonged use. In this connection it might be stated that no difficulty has been reported in the field although gasolines with extremely high antioxidant concentrations have been used.

Information on the gum tolerance of small stationary engines such as employed by the Army for pumping units, battery chargers, etc., was obtained by operating six different engines on gasolines of various gum contents. Because the 10 mg. gum gasoline caused difficulties in the vehicle tests, a 7 mg. fuel was added to the ones already tested, otherwise the fuels were similar to those employed in the second road test.

In general, the results of the tests agreed with the vehicle tests; that is, all gasoline containing more than the lowest gum level (1.5 mg.) caused sufficient engine deposits to significantly reduce the operating time between overhauls.

Army mechanics and technologists tearing down a truck engine to examine the effects of operating the vehicle on high gum content gasoline

The effect of gum was to cause heavy deposits in the intake manifolds and ports, on intake valve stems and guides and on intake valve tulips.

The various groups working on gasoline stability and related subjects have accumulated a tremendous amount of information. The need for quick answers to the questions asked by the Ordnance Department has permitted only partial analysis of the data on hand. Careful study of the reports will undoubtedly lead to a better understanding of this subject and to better techniques for the evaluation of gasoline behavior in storage and in engines.

Appendix A—Army Specifications for Three Grades of Motor Fuel Used in Stability Tests

Army 2-103 B Motor Fuel (All Purpose)

	A All Purpose	C Arctic
ASTM Distillation		
10% evap., °F.	140-158	122 max.
50% evap., °F. max.	221	203
90% evap., °F. max.	329	302
Residue, % max.	2	2
Vapor Pressure, psi max.	8	12
Octane No., ASTM min.	80	80
Gum, mg./100 ml. max.	4	4
Sulfur, % max.	0.25	0.25
Corrosion	none	none
TEL, cc. gal. max.	3	3
Oxid. Stab., minutes, min.	480	480

Army 2-114 Motor Fuel (72-Octane)

	A	B	C
ASTM Distillation			
10% evap., °F. max.	160	145	130
50% evap., °F. max.	284	257	250
90% evap., °F. max	392	356	356
Residue, % max.	2	2	2
Vapor Pressure psi max.	9	10	13
Octane No., ASTM min.	72	72	72
Gum, mg./100 ml. max.	7	7	7
Sulfur, % max.	0.25	0.25	0.25
Corrosion	none	none	none
TEL, cc. gal. max.	3	3	3
Oxid. Stab., minutes, min.	240	240	240

Note: Grades A, B, and C are seasonal for localities as specified.

Army 2-116 Gasoline (Unleaded and Undyed)

A break-in gasoline for engines just prior to storage

ASTM Distillation	
10% evap., °F. max.	167
50% evap., °F. max.	284
90% evap., °F. max.	392
Residue, % max.	2
Vapor Pressure psi max.	9
Octane No., ASTM min.	62
Gum, mg./100 ml. max.	4
Sulfur, % max.	0.25
Corrosion	none
Oxid. Stab., Minutes, min.	480

Effect of Preformed Gum in Fuel Tested in Ordnance Equipment

ADDITIONAL DATA from the tests conducted under Army Ordnance supervision on the effects of preformed gum in motor gasoline on vehicle operation were reported at the annual meeting of the Society of Automotive Engineers in Detroit in January. These data were given in a report of the Gum Tolerance Group of the CRC Gasoline Additives Projects entitled "Gasoline Gum Tolerance of Ordnance Equipment." The report was presented by M. L. Alspaugh, Technical Service Department, Research Laboratories, Ethyl Corp., leader of the group.

Their work covered the two tests on vehicles at Camp Bullis, Texas, discussed in the preceding article and also a test on stationary engines at San Bernardino, Cal. The conclusions of this group in brief were:

1—In general, to insure freedom from excessive engine deposits due to gasoline gum, the gum content of the fuel should be kept below 7 mg. for continuous use in any type of unit.

2—The detrimental effects of gasoline gum were not in proportion to the gum content of the test fuels. Inspection of parts showed a marked difference between the condition of engines operated on 1.5 mg. gum fuel and engines operating on 7 mg. or more gum. However, very little difference was evidenced in the condition of engines operated on fuels containing between 7 and 50 mg. gum.

In the first of the vehicle tests at Camp Bullis, three fuels were made up by blending 2-103 B specification gasoline with a fuel containing approximately 900 mg. of gum. This latter high-gum fuel was an uninhibited, naturally-aged cracked stock. The test fuels had an ASTM gum content of 1.5, 10 and 25 mg. per 100 ml. respectively. The fuels contained 3 cc. of tetraethyl lead and 35 lbs. of antioxidant per 1000 bbls. (see Table 1). This test was conducted, from Oct. 15, 1944, to Jan. 15, 1945, in four trucks of from ¼ to 4 tons capacity and in a light tank, medium tank and a gun motor carriage.

All vehicles for both tests were equipped with new engines and fuel systems. After a break-in run of 500 miles for the wheeled vehicles and 50 miles for the track-laying vehicles, a complete inspection of the fuel and induction system of each vehicle was made to insure that all parts were clean and free from deposits.

Duration of the first test was 5000 miles for the wheeled vehicles and 100 road hours for the track-layers. The ambient air temperature averaged about 50° F. and did not exceed 70° F.

In the first test, examination of the engine parts after disassembly indicated that for all engines tested only slight differences were obtained in the amount of deposit as the gum content of the fuel increased. The vehicles operating on the 10 and 25 mg. gum fuels contained no abnormal deposits and there were no significant differences in engine deposits or engine cleanliness. Deposition was greatest on the intake ports and on the intake valve tulips. The fuel systems of all vehicles were clean and free of deposits, with the exception that the choke valves of one vehicle stuck when operating on the 25 mg. gum fuel.

In view of these results it was recommended that further tests be made at ambient air temperatures of above 70° F. with fuels containing up to 50 mg. gum, using a greater variety of vehicles and extended mileages. The high-gum fuels for the second test were made by blending 2-103B specification gasoline with a naturally-aged cracked stock containing 30 mg. of gum. To make the 50 mg. gum fuel, it was necessary to add approximately 5% of the 900 mg. gum fuel from the first test (see Table 1). The duration of the second test was 10,000 miles for wheeled vehicles and 150 road hours for track-layers.

The results of the second test using vehicles where the ambient air temperature was above 70° F. and at greater mileages than in the first test differed materially from those of the first test. In general, stated the Alspaugh report, they indicated that the use of fuels containing 10 mg. or more of ASTM gum result in excessive engine deposits that may shorten the duration of satisfactory operation of the vehicle.

A consideration of over-all engine cleanliness for the same vehicles indicated that slightly dirtier engines were obtained as the gum content of the fuel increased, it was reported. The greatest comparative increase in both engine deposits and piston skirt lacquering was evidenced between fuels containing 1.5 and 10 mg. of gum.

"As a general rule," it was stated in discussing the results of the second test, "fuels containing between 10 and 50 mg. gum showed very little difference in the amount of induction system deposits. Examination of the various engines operating on the high-gum fuels showed that the deposits formed had a tendency to become hard and brittle as the gum content of the fuel increased. There was some evidence that the deposits resulting from the use of 50 mg. fuel were more inclined to flake and break away. This may have had some bearing on the fact that the difference between the amount of deposits from 10 and 50 mg. fuel was so small."

The general conclusions drawn from these CRC tests of the effect of preformed gum in fuels on engine deposits were given as follows:

"In the over-all picture, the detrimental effects of gasoline gum were not in proportion to gum content within the limits used in these tests. Inspection of parts showed a marked difference between the final condition of engines operated on 1.5 mg. gum fuel and engines operated on fuel containing 7 mg. or more gum. However, very little difference was evidenced in the condition of engines operated on fuels containing between 7 and 50 mg. gum. The number of hours and miles of operation must be taken into account, of course, when considering the relative appearance of engine parts.

"In general, the results of both road and stationary engine tests indicated that, to insure freedom from excessive engine deposits due to gasoline gum, the gum content of fuels should be kept below 7 mg. for continuous use in any type of unit."

TABLE 1—Inspection Data on Gasolines Used in Tests on Effect of Gum in Fuels on Engine Deposits

	First Test			Second Test				
ASTM Gum Content, mg./100 ml.	1.5	10	25	1.5	10	25	50	25°°
Gravity, °API	57.5	57.2	57.0	61.7	60.5	60.2	59.3	60.7
Distillation, ASTM°								
IBP, °F.	109	110	106	110	106	107	104	115
10% Pt.	145	146	147	147	148	148	149	155
50%	227	229	230	213	228	243	244	221
90%	335	340	342	299	338	350	355	309
EP	379	386	391	357	388	395	402	383
Reid vapor press., psi	6.4	6.4	6.4	6.6	6.7	6.8	6.7	6.1
Induction period, min.	625	398	324	800	130	70	65	300
Copper dish gum, mg./100 ml.	7.5	76.4	110.7	5.5	121	243	323	71
5 hr. Army accel. gum, mg./100 ml.	34.9	251.8	294.1	14	900	1250	1000	500
Sulfur, %	0.052	0.052	0.050	0.03	0.10	0.14	0.17	0.05
Octane Number								
ASTM Motor method	81.0	81.0	80.5	80.0	78.5	78.0	77.5	79.0
CFR Research method	91.0	91.0	90.5	84.5	85.5	86.0	85.5	84.0

° Distillation data were based on per cent recovered for first test and per cent evaporated for second test.
°° Blended as in first test.

Tomorrow . . . IN PETROLEUM TECHNOLOGY

Preview of What's Ahead . . . Based on Todays' Technological and Economic Developments

This series is concerned with technical and economic developments which have a direct bearing upon the future of petroleum refining operations. Topics projected this month include: news of the Goodrich purchase of Phillips Petroleum's share in Hycar Chemical; discussion of du Pont's creation of a new petroleum chemicals division and a rearrangement of Shell's organization in this field; new facts on specifications for future gas turbine and jet plane fuels; comments on the future use of aerosol insecticides.

Also included are comments on new developments in tar sand bitumens; remarks on the chemical requirements of petroleum refining; an important reference to possible deleterious effects of organic chlorine on the octane number and lead response of gasolines; possible market effects of the introduction of a "twice-a-year-drain" motor oil; and a prediction that versatile, German-developed synthetic fatty acids will shortly appear on the domestic scene.

Phillips and Goodrich Sever Association

Several prominent chemical companies have recently taken steps to reorient their activities in the field of chemicals from petroleum. Among these is the acquisition by B. F. Goodrich Co. of the ownership share in the Hycar Chemical Co. formerly held by the Phillips Petroleum Co.

Hycar Chemical was one of the first joint enterprises established by a petroleum and a chemical company. It was announced as a logical merger between a company skilled in the production of raw materials and one which possessed manufacturing and marketing experience in regard to finished products, in this case, synthetic rubber.

It is doubtful that a lack of success had anything to do with this new move, for the enterprise, because of wartime demands, had no chance to fail. Similarly, it is certain that neither company has lost its interest in the field of chemicals and synthetic rubber. Goodrich, through its purchase, obviously intends to continue operations, probably in connection with its ventures into the plastics field. Phillips, a leader in light hydrocarbon research, only recently set up a pilot plant group to study further such reactions as polymer synthesis.

The reasons for the separation are thus not obvious ones, being probably concerned with future operations in which joint action did not appear desirable. In any case, the new B. F. Goodrich Chemical Co. will be watched with increasing interest, as will further chemical activities of Phillips.

Du Pont Creates New Petroleum Chemicals Division

Perhaps as a prelude to increased activity, also, du Pont has consolidated two divisions of its Organic Chemicals Department into a new unit bearing the title of the Petroleum Chemicals Division. The two former divisions were the Alcohol and Tetraethyl Lead Divisions, which operated plants at Deepwater, N. J., and Baton Rouge, La. It is highly probable that operations controlled by still other divisions are also involved or at least closely co-ordinated with the new division.

There has never been any question concerning du Pont's interest in the production of chemicals from petroleum. Several years ago the author of this series made a survey of patents issued to du Pont from 1936 to 1941 and determined that over 800 patents out of the estimated 2800 obtained were "of present or possible eventual interest to the petroleum industry." This figure is of even greater interest than was at first apparent because the 800 patents considered did not include those dealing with the preparation of end products for marketing, such as steam treating of stockings made from Nylon yarn.

"Du Pont is actively engaged in many fields in which petroleum hydrocarbons or derivatives may be or are being used. This is true of many substances in the fields of resins and plastics, halogenated hydrocarbons, acids, esters, alcohols, hydrocyanic acid, etc., and may become true in the fields of synthetic rubbers, detergents, and Nylon." This from its 1941 report certainly did not understate the case.

Du Pont possesses one of the best research organizations in this country and may certainly be expected to continue to co-ordinate it with its well-informed activities in the production of consumer chemical products. The new petroleum chemicals division will be viewed with close attention by all interested parties.

Shell Chemical Corp. Takes Control of Chemical Activities

Shell Oil Corp. has announced the creation of the Shell Chemical Corp., which will take over the operations formerly directed by the Shell Chemical Division of the parent company. It is probable that this move was connected with some internal business reasons, but it serves again to call attention to the extensive chemical activities of the Shell organization.

Shell now operates chemical plants at Shell Point, Martinez, and Dominguez, Calif., and the new corporation will soon absorb the Houston, Texas, plant and will continue to operate a butadiene plant at Torrance, Calif., for the ORR. Major products include "ammonia, fertilizers, solvents, and industrial chemicals."

One petroleum executive, prior to the war, is known to have remarked; "we have no way of knowing how profitable or nonprofitable the manufacture of chemicals has been for Jersey (Standard) and Shell, but in view of the highly competitive markets with which both are concerned it is doubtful whether profits have been attractive." Wartime demands for petroleum chemicals probably reversed this situation for Shell if it ever existed, and it is highly likely that the new subsidiary, through its "further development of petroleum derivatives," will continue to play a leading role in the petroleum chemicals field.

Fuels for Gas Turbine and Jet Planes Receive Attention

Comment on jet propulsion fuels, made last year,(1) was to the effect

(1) Anon., "Keeping Up With the News—Jet Propulsion Fuels." NATIONAL PETROLEUM NEWS *TECHNICAL SECTION* 37, No. 27, R-558 (1945).

that one of the early criteria was the "ability to supply a maximum number of heat units per pound, in order to extend the flight range." However, another source, quoted in the same article, had even then "pointed out that a somewhat converse situation may exist—one in which the volume of fuel load is the dominant factor rather than the weight. Where weight considerations are dominant, a fuel approaching gasoline in properties would be indicated, whereas, otherwise, 'heavier' fractions would seem more desirable."

Further information on this subject is now available. For example, Lt. Gen. James H. Doolittle recently told the API, in a speech on suggested lines for petroleum research, "thus far we have generally used kerosene or gasoline operationally in jet aircraft. Extensive investigation is indicated to explore the optimum in jet fuels for our future air force which to a large degree will consist of turbo jet and gas turbine powered interceptor, fighter, and bomber aircraft. **We know that limitation of space will be a dominant factor in the future and that Btu per gallon rather than pounds per gallon, Btu per pound will be the determining factor.**"(2)

Another recent paper(3) gives somewhat more details on this and other related aspects.

"In the gas turbine engine, detonation has no counter-part because of the continuous combustion, and the concept of octane number in its various forms has no significance. Power is limited by the maximum permissible turbine blade temperature. Differences in dissociation phenomena and in specific heats of fuel affect peak temperatures and pressures in the reciprocating engine, but in the turbine engine differences in fuel composition have little effect, since dissociation effects are negligibly small due to the lower temperatures permitted at the blades. Should the blade temperatures ever reach the neighborhood of 2000° F. or above, the effect may then become noticeable.

"On the other hand, fuel composition does affect the flame speed, and if the fuel is not completely burned before it has passed the turbine or even the tail pipe, the efficiency of the engine will be lowered. In addition, intermediate combustion products are always likely to be chilled on cold walls and form deposits which restrict heat flow through the wall. The carbon-hydrogen ratio is an important fuel property in deposit formation. The degree of importance will depend upon the geometrical arrangement of the combustion chamber, temperatures of the walls, speed and turbulence of the air streams, and rate of mixing and vaporization of the fuel. Thus engine design will largely determine the permissible limits.

"The volatility of a fuel will also have considerable influence on the formation of combustion chamber deposits, since non-vaporized fuel tends to polymerize or crack to solid materials. The gas turbine can use heavier fuels because the fuel can be atomized under pressure and sprayed into an air stream already heated by compression.

"In gas turbine engines also, economy means using the fuel with the highest possible Btu content. But whereas in propeller-driven airplanes weight is always at a premium and space for fuel is amply available in the wings, the very thin wing profiles for high speed jet-propelled planes offer no space for fuel, and the premium may shift from weight to space. In that case the fuel should have a high Btu content per gallon, rather than per pound. . . .

"Fuel cost may constitute 10% or more of the total expense of an airline, and will therefore influence the direction of future developments. Fuel costs unfortunately cannot be predicted at this time, but it is certain that under normal conditions no fuel will be offered at a price lower than that which it can command in some other field."

Aerosol Insecticides Challenge Regular Oil-Base Sprays

Reams of paper are being devoted to advertisements of aerosol bombs for civilian use. Some 25 manufacturers are making or will produce these items, which were so successful during the war that about 40,000,000 were used by the armed forces in their struggle against harmful insects.

At present, aerosol bombs constitute a premium-price insecticide dispenser, a fact which the intrigued public may not realize. Indeed, it may never become aware of this, since "they already have dropped from an introductory cost of $4 to under $2.50. During the coming year we are promised aerosols appreciably below $2."(4) One pertinent development is a 4-oz. refillable aerosol, something which may "be the answer to the objection that the aerosol is costly."

The formula for the Army's insecticide "called for 3% DDT, 2% of a 20% pyrethrum concentrate, 5% cyclohexanone, 5% lubricating oil, and 85% Freon gas as propellant." Civilian formulas may not differ greatly from this, with DDT contents of 1-3% considered safe by Federal authorities.

Many petroleum companies have profited considerably from the sale of insecticides in which petroleum distillates, such as naphthas, are the carrying vehicles, either through marketing such items themselves or by selling the distillates to specialty producers. It would certainly be premature to state that this market is seriously threatened. However, few petroleum companies so engaged have failed to include the aerosol bomb in their research and marketing programs, "just in case."

It may be noted that the present formula includes some "lubricating oil," more probably an industrial oil of specific qualities. In any case, DDT and the aerosol bomb have made it certain that civilian insecticides will differ considerably from those marketed before the war.

Tar Sand Bitumens Again Being Studied

Several happenings in regard to the recovery of liquid fuels from tar sand have again attracted attention to this subject.(5)

Following a disastrous fire which destroyed the plant of the Barber Asphalt Corp. at Bonanza, this company had joined with the Standard Oil Co. of California to form the American Gilsonite Co., which "will shortly have under intensive development 'the world's only known important source of Gilsonite' in eastern Utah and western Colorado."(6)

Gilsonite, "a bright, black hydrocarbon resembling glossy asphalt, is closely related to petroleum."(7) Prior to the war, it was chiefly used in the manufacture of storage battery cases and foundry forms. It was also used in paints, varnishes, inks, and lacquers, and it is said to have potentialities as a binder for plastics.

According to the announcement, Gilsonite "is considered of importance as a possible future source of synthetic crude oil." It occurs in almost pure form, hence mining is inexpensive. As mentioned in earlier articles,(5) "eastern Utah also contains vast deposits of almost pure asphaltum (in Uintah County)," so it is possible that both types of bitumens may be developed as sources of synthetic oil.

In Canada, the province of Alberta has asked the Dominion Government to abandon its research at the fire-ravaged plant of Abasand Oils, Ltd., and join in efforts to develop the

(2)Anon., "Convention Paper Abstracts." *Chem. & Met. Eng.* 53, No. 1, 263 (1946).

(3)A. G. Cattaneo et al, "Outlook on Fuels for Conventionally-Powered and Gas-Turbine-Powered Aircraft." *Automotive and Aviation Ind.* 93, No. 12, 30 (1945).

(4)Anon., "Aerosol for Civilians." *Industrial and Engineering Chemistry* 37, No. 12, Suppl. p. 14 (1945).

(5)Anon., "Keeping Up With the News." NATIONAL PETROLEUM NEWS, TECHNICAL SECTION, 36, No. 40, R-724, R-725 (1944); 37, No. 36, R-744; No. 40, R-816 (1945).

(6)Anon., "California Standard and Barber to Develop Gilsonite Deposits." NATIONAL PETROLEUM NEWS 38, No. 2, 39 (1946).

(7)Anon., "Develop Gilsonite." *Business Week*, No. 854, 67 (1946).

richer deposits near the experimental plant of Oil Sands, Ltd.[8] This news definitely implies that the Dominion has not yet returned Abasand Oils to private ownership, an action previously reported[5] as planned for late last year.

In fact, the Canadian Minister of Mines and Resources, J. A. Glen, has informed the Alberta government that "the federal government has not reached a final decision as to future operation of the Abasand plant and that, under an agreement with the Abasand Co., the company's contractual rights in the plant and property must be considered."[8]

A report issued by Glen[9] confirms again the economics reported in previous issues of this series.[5] Much information will be required before the near-future importance of Canadian tar sands becomes apparent.

Chemical Requirements of Petroleum Refining

So much attention is now being given to the manufacture of chemicals from petroleum that it is seldom realized that the petroleum industry is also a very large consumer of chemicals. This fact was well understood during the war by PAW and the refiners themselves, faced with the necessity of obtaining chemicals vital for their operations, but the impressive totals involved were not always clear.

It is interesting to note, therefore, that the chemical industry is well aware of the significance of petroleum refining as a user of chemicals.[10] A PAW survey, made in 1942, showed that sulfuric acid, clay, sodium hydroxide, and tetraethyl lead fluid were needed in the greatest quantities; despite the changes occasioned in refining by the war, a brief survey of eight refineries still shows these to lead in demand.

War-developed catalytic processes have made significant additions to the 1941 list, however, such as hydrofluoric acid. Chemicals now enter into almost every phase of petroleum refining—fractionation, chemical treating, catalytic cracking, alkylation, polymerization, isomerization, dehydrogenation, etc., and their use is conducive to the production of improved products. Demands will continue to grow as operations multiply and become more complex.

(8) Anon., "Alberta Asks Dominion Aid to Extract Oil from Sands." NATIONAL PETROLEUM NEWS 38, No. 2, 61 (1946).

(9) Anon., "Alberta's Fuels." *Business Week*, No. 852, 112 (1945).

(10) Anon., "Chem. & Met. Report on Chemical Requirements of the Petroleum Refining Industry." *Chem. and Met. Eng.* 53, No. 1, 139 (1946).

Effect of Organic Chlorine On Octane No. and Lead Response

It is fairly common knowledge that the presence of a small amount of many organic sulphur compounds has a deleterious effect upon the octane and lead susceptibility of gasolines, but it is not generally known that such organic chlorides as may be formed in operations using aluminum chloride may also behave in a similar manner.

A recent paper[11] serves as warning that this is true—so much so, in fact, that concentrations of 1% may actually negate the value of adding 4cc. of tetraethyl lead. While "gum and corrosion tests were negative at chlorine concentrations of 0.1 wt.-% and lower, the effect of organic chlorides on lead susceptibility was so great as to indicate that, above 0.001 wt.-%, chlorine should not be tolerated in gasoline, although this limit might be raised somewhat, depending on whether the particular chlorides present are normal, secondary, or tertiary."

This does not mean, of course, that chlorine-containing catalysts and treating agents should not be used, since efficient methods of controlling chlorine content are not difficult to apply. It does signify, however, that refiners will do well to consider the possible effects of residual amounts of this and other chemicals and to take proper precautions in controlling certain refining operations.

Union Oil Introduces Long-Life Motor Oil

Petroleum companies, the automotive industry, and the public alike are noting with interest the recent announcement by the Union Oil Co. of California of a "twice-a-year-drain" motor oil which, if used, would eliminate the traditional 1000-mile oil change. "New Triton," the oil in question, is reported to be a compounded oil which is much superior to straight mineral oils in engine wear and oxidation rate.

There has long been much debate concerning the necessity for changing oil every 1000 miles, especially when a premium-grade, inhibited lubricant is used, when the motor is kept in good operating condition, and when a good oil filter is installed. There is no question, of course, that present-day automobile engines present more serious problems than those of a decade ago, when inhibitors were rarely used or needed, but the war has added greatly to the petroleum industry's knowledge of additive properties.

(11) Holloway, Clark, Jr., and Bonnell, W. S., "Octane Number and Lead Susceptibility of Gasoline; Effect of Organic Chlorine and Sulphur." *Industrial and Engineering Chemistry* 37, No. 11, 1089 (1945).

Union Oil's experience with its new oil will be watched carefully as a test of public acceptance of what may possibly appear to many war-made-cautious drivers as an invitation to recklessness.

Synthetic Fatty Acids Attract Attention

One of the many attractive features of the Synthine (Fischer-Tropsch) process is the possibility of producing profitable substances from certain of the major products. This fact has been forcibly brought into the limelight by release of German-developed data, and it is nowhere more apparent than in the case of those synthetic fatty acids which may be synthesized by oxidation of the paraffin wax produced.

It is true that other paraffins may be and have been used, but few possess the straight-chain molecular structure which yields acids similar to those produced by Nature and widely used in edible products, soap, etc. During the war, synthetic products of these types were produced in the thousands of tons per year in Germany, and there is no record that these products were inferior just because their use was induced by war-born shortages.

Some idea of the versatility of the fatty acids produced may be gained by a brief survey of German uses. The C_1-C_4 acids, recovered from the effluent gases, were used for the treatment of fodder silos, the esterification of cellulose, and the preservation of bread. The C_5-C_{10} acids were normally separated, by distillation, into C_5-C_7, C_7-C_9, and C_9-C_{11} fractions; the first two, on hydrogenation, yielded alcohols which were reacted with phthalic anhydride to yield alkyd resins, while the latter was normally used for the separation of minerals by flotation. The C_7-C_9 fraction was also used in foamite-type fire extinguishers.

The C_{10}-C_{18} fraction was the second isolated by vacuum distillation, the C_5-C_{10} group being the first. These acids were directly used in the manufacture of soaps and edible fats. In the production of the latter substances, the C_9-C_{16} fraction was usually employed, following removal of dicarboxylic acids by treatment with dilute sodium hydroxide.

The next higher fraction, the C_{18}-C_{24} acids, have found use in the production of greases, in the form of sodium, calcium, and lithium soaps, and as softening agents for leather, in combination with triethanolamine. Lubricants for plastic molding have been produced from the zinc, magnesium, and calcium soaps. Numerous products were also prepared from the pitch-like distillation residue.

PLANT PRACTICES

. . . for refinery Superintendents and Foremen

Practical Tips and Ideas on "HOW TO DO IT" in the Refinery Based on Actual Operating Experience

Running a refinery is a practical operation, requiring "know-how", experience and ingenuity. Every plant has some special procedures and methods, which have been worked out to meet its own peculiar problems —problems which may also exist in other refineries.

To make these ideas more generally available to refinery superintendents and foremen, the men who can put them into practice in their own plants, the Technical Editors of National Petroleum News are starting this feature — Plant Practices.

This month we present suggestions on (1) a novel contest to impress employes with the importance of small oil leaks around a refinery, (2) chemical methods of cleaning bubble towers that save time, material and labor, and (3) a schedule board that shows at a glance the jobs that each employe can handle and where he is working.

Contest Stresses Importance of Small Drips, Shows How They Can Mean Big Oil Losses

The following description of how one refinery carried out an educational program to stop oil losses was written from material supplied by A. B. Stevens, Conservation Engineer for a large west coast oil company.

MANY sources of oil loss in refineries, which could be corrected and stopped merely as a matter of routine operation, continue to drip away thousands of barrels daily—thousands of barrels of lost profit.

For the most part, the reasons these losses aren't corrected lie with the employes—lack of concern, ignorance of the amount of leakage, improper or incapable supervision. They frequently do not realize the large wastage of products which accumulates from small losses going on right under their eyes.

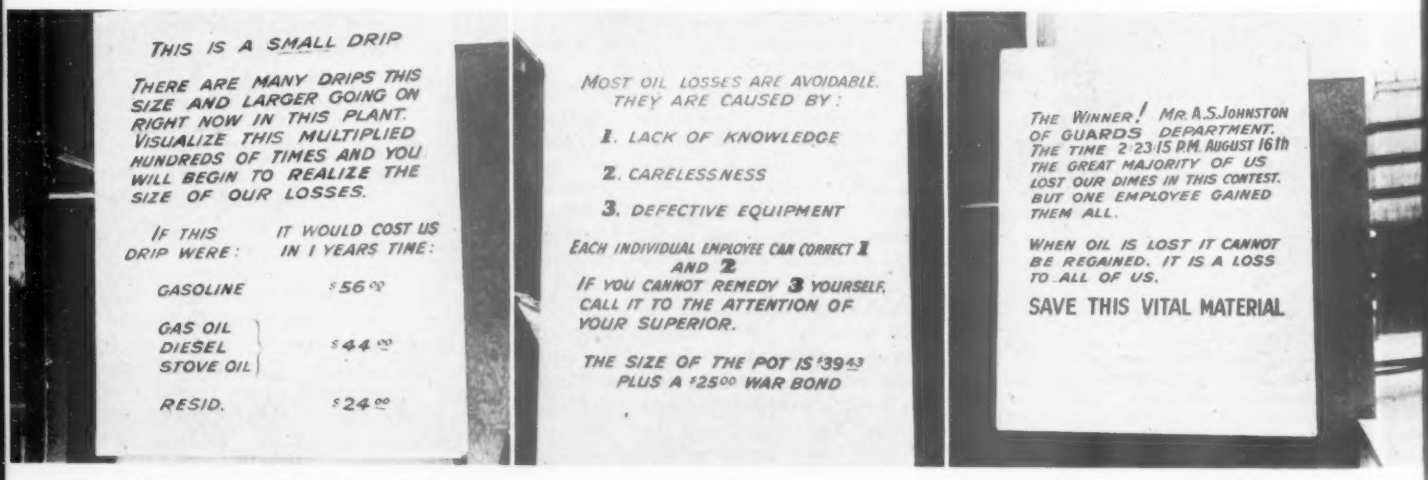
Each of the persons around the plant normally sees only a limited space in his own operating area, and often does not consider a drip or two as important. But the same conditions may exist throughout the plant and, when added up, make a total of large proportions.

In order to impress on its employes the magnitude of small losses, one large west coast refinery recently undertook an unique educational program. Posters along conservation lines, while undoubtedly beneficial to a certain extent, were thought to have too rapidly passing an effect. So the refinery management hit upon the idea of a contest which would hold the workers' interest and leave them with a lasting impression of how small leaks and drips build up into barrels of lost oil and product.

A display was set up as shown in the accompanying photograph, containing a glass-front cabinet in the center, with signs on either side explaining the set-up. A 55-gal. drum of oil was placed in the top of the cabinet and below it in the glassed-in portion was placed an empty barrel (42 gal., approximately). A visible drip of oil was started from the upper drum through a valve assembly, simulating a bleeder valve, into the barrel below.

The object of the contest was to have the employes guess how long it would take for the dripping oil to fill the lower barrel. An electrical float switch was arranged on the barrel so that an electric clock would stop when 42 gal. of oil had dripped into it.

To add a bit more interest, the employes were asked to put up ten cents with each guess, which was later awarded to the winner together with a $25 war bond from the company. Judges were


THIS IS A SMALL DRIP
THERE ARE MANY DRIPS THIS SIZE AND LARGER GOING ON RIGHT NOW IN THIS PLANT. VISUALIZE THIS MULTIPLIED HUNDREDS OF TIMES AND YOU WILL BEGIN TO REALIZE THE SIZE OF OUR LOSSES.
IF THIS DRIP WERE: IT WOULD COST US IN 1 YEARS TIME:
GASOLINE $56.00
GAS OIL DIESEL STOVE OIL $44.00
RESID. $24.00
MOST OIL LOSSES ARE AVOIDABLE. THEY ARE CAUSED BY:
1. LACK OF KNOWLEDGE
2. CARELESSNESS
3. DEFECTIVE EQUIPMENT
EACH INDIVIDUAL EMPLOYEE CAN CORRECT 1 AND 2
IF YOU CANNOT REMEDY 3 YOURSELF, CALL IT TO THE ATTENTION OF YOUR SUPERIOR.
THE SIZE OF THE POT IS $39.43 PLUS A $25.00 WAR BOND
THE WINNER! MR. A.S. JOHNSTON OF GUARDS DEPARTMENT. THE TIME 2:23:15 P.M. AUGUST 16th
THE GREAT MAJORITY OF US LOST OUR DIMES IN THIS CONTEST. BUT ONE EMPLOYEE GAINED THEM ALL.
WHEN OIL IS LOST IT CANNOT BE REGAINED. IT IS A LOSS TO ALL OF US.
SAVE THIS VITAL MATERIAL

The above are posters which were used by a large West Coast refinery, in connection with a contest to guess the time required for a drip of oil to fill a barrel, to impress its workers with the total amount of oil that can be lost through small continuing leaks

appointed to start the contest, seal the cabinet, pick the winner and make the award—$39.43 in cash plus the bond.

During the period of the contest, midnight oil burned brightly, for the problem of figuring the time was a real test of crystal gazing and mental capacities. One employe confided that he had used his wife's medicine dropper and had dropped until he had filled a small bottle. On the basis of his count there were 5,107,200 drops in 42 gal. and he was sure he could figure the time out pretty well.

Others rigged up their own pet drippers or caught drips about the plant and measured them. Others, resorting to more erudite methods, used graphs, integrals and slip sticks. Regardless of methods used the answers were widely different.

There was one thing that none of them could figure correctly, and that was the marked effect of changing temperature and lowering head in the upper barrel on the rate of dropping. When first started, during the heat of the day, the drops were dropping at the rate of about 200 per minute. Towards the last, during the cool of the nights, the rate had reduced to less than 100. The oil, kerosene, also evaporated somewhat during the dripping period. This threw another little complication into an already complicated problem.

The clock stopped 20 days, 2 hours, 8 minutes and 15 seconds after starting. The winner's guess was only 2 minutes and 45 seconds off. Probably the only one who was sure of his money was the employe who bet all comers that their guesses were wrong. We understand he made some $30.00.

General view of the setup used in the oil-leak contest. Oil in the upper drum was allowed to drip into the lower barrel, the object of the contest being to estimate the time required for the lower 42-gal. barrel to be filled

It is felt that this contest was effective. It caught and held the interest of the employes for a long period. Signs containing pertinent comments, as shown below, were posted frequently in order to drive the theme home. All refinery employes had to pass the spot twice a day and were given a fine opportunity to do some thinking along the lines for which the contest was designed, and they had fun doing it.

Chemical Methods for Cleaning Bubble Towers Save Down-Time, Man-Hours, Materials

A CONSIDERABLE savings in "down-time" as well as man-hours and materials is achieved by some plant operators through the use of chemical methods for cleaning bubble towers, in place of either dismantling the tower or removing deposits by hand-cleaning through the man-ways. However, some refinery and natural gasoline plant maintenance men contend the only sure way to clean a tower is by sweat and elbow-grease.

No chemical method will remove deposits consisting largely of hard, baked-on carbon or coke, found especially in refinery towers operating above 700° F. Except for such cases, and in the absence of laboratory examination of the deposits, many maintenance men prefer to try the chemical method first because it generally serves to loosen even stubborn types of deposit, thus reducing time and effort during manual cleaning.

Usual procedure of one company is to first wash the tower well with water, removing oil adhering to the surfaces when the tower is emptied. Water from the refinery or natural gasoline plant mains is satisfactory, if under sufficient pressure to circulate at 30-50 gpm; otherwise a pump will be required. Some operators prefer to use hot water.

Second step involves an alkaline cleaning solution. About 15% caustic is frequently used, although the several commercial preparations containing this material plus tri-sodium phosphate or similar compounds are the choice of others. Cleaning solution is heated, usually, to 140-150° F; other operators use temperatures ranging to 180 or 200° F. Temperature in part is dictated by experience and recommendations of the manufacturer in case of commercial preparations. Circulation at the highest possible rate available pumps will maintain is continued for usually two hours.

Third step is again water-washing, generally an hour's washing being sufficient.

Fourth step is an acid wash for three to four hours. Concentration of acid, if commercial concentrated hydrochloric acid is used, generally is 15% by volume or the manufacturer's recommendation if a commercial preparation is involved. Temperature of the acid wash is generally 180° F. in practice, heating being external rather than by steam injection to avoid dilution of the acid.

Fifth step is the removal of acid in the tower, again by water-washing for one hour, whence the whole cycle is repeated. When inspection reveals no more deposits are being removed, tower is ready to be put back on stream.

Using this method, one large natural gasoline manufacturer reports the treatment for 36 hours at a time, ordinarily, is sufficient to restore 90% of absorbers and fractionators in a number of plants to full efficiency.

Another operator reports a slightly differing procedure, especially since there is considerable hydrogen sulfide contamination in the vapors to absorbers and stabilizers. Procedure here is to use chemical cleaning in order to break the gummy material and oil cementing the sludge—consisting largely of iron sulfide—to the tower parts. Tower then is blown with air to oxidize the sulfide to iron oxide, taking precautions meanwhile to prevent the sulfide's catching fire and actively burning. Although the active combustion itself would do no harm, the resultant high temperatures may cause serious damage to tower and trays. If fire occurs, it must be smothered by stopping the air blower and, if necessary, by closing the manholes.

Iron oxide—rust—resulting from the oxidation of iron sulfide then is flushed from the tower by water. In this connection, a refinery maintenance authority stresses necessity of having a high

water velocity in the tower to flush out the deposit. He points out that 5 ft per sec. velocity is necessary to move sand, while iron rust and mill scale will require a considerably higher velocity. If deposits are known to consist of such materials, it is useless to attempt to flush them out unless a very large pump is available.

Another operator points out that it is useless to use chemical cleaning unless good circulation of the cleaning fluid is possible. One case in his experience was a six-year old absorber tower, never cleaned before and badly clogged. Chemical cleaning with commercial preparations was resorted to and continued until inspection of effluent indicated no more deposits were being removed. Adequate circulation in the tower was restored which apparently was thoroughly cleaned, but operation indicated after two weeks that yields were still off, probably due to inadequate steam stripping of the oil.

Tower then was cleaned manually, inspection revealing the chemical had satisfactorily cleared the upper trays, but had re-deposited sludge in the bottom parts of the tower where fluid velocity was not adequate to carry them out. Since the re-deposition largely prevented chemical action on the original deposits existing on these trays, it was necessary to scrape them clean.

No unusual equipment is necessary for chemical cleaning. Required is a vat or tank to serve for mixing chemicals and as a surge tank, a good pump (preferably the largest available, one operator cautions), necessary connections to tower and tank with provisions for reversing flow desirable, and steam lines for heating the solutions—externally for the acid wash solution to avoid dilution. Many operators also provide one or two steel drums in the return line to the surge tank, serving as a settler for dropping out sludge and deposits removed by the treatment. Some also install a baffle in the surge tank for additional settling.

Volume of treating fluid must be sufficient to fill the tower and lines plus approximately 100 gal. for circulation. Concentration of the alkaline solution generally is 15-20% by volume, sometimes as high as 50%, depending on toughness of the job, manufacturer's recommendations, or experience with the particular item of equipment. Concentration of acid in the acid wash should not be high enough to risk attack on the metal of the tower or internals.

Scheduling Board Shows Employes Available For Special Jobs, When They Are on Duty

THE problem of keeping straight the schedules of all the personnel in the Operating Department at Pure Oil Co.'s Toledo Refinery has been solved by the simple expedient of a schedule board.

This schedule board, described below, has proved an easy way to keep the shift foremen accurately advised at all times of the men on their shifts and of all changes, both temporary and regular. The personnel in the Operating Department, as well as the foremen, have also found in it the answer to many of their questions on overtime, vacations and up-grading.

The board is made of map board 3 feet by 5 feet and is encased in a wooden frame, covered by glass and is hung on the wall back of the Timekeeping Department.

All the employes working in the Operating Department are listed on the left side of the board according to classifications, starting at the top with the Operators, then the Assistant Operators, etc., down. This list is a series of slides so that the names may be moved. The right hand side of the board is another series of slides into which slips showing vacation or any other extended leave dates are inserted.

Across the top of the board are listed the various units and extended down from them are the jobs on these units. Lines are drawn on the board vertically from the job slides and horizontally from the name slides, thus forming a box opposite each man's name and under each job.

The record on the board is kept by placing colored pins in the boxes. A blue pin is placed opposite the man's name and in the boxes under all jobs the man can work (whether a man is qualified to work a job is established by his foreman's endorsement as to his ability). A red pin, having the letter of his shift on its face, is also placed in the box under the job he is working; if the man is on vacation or not working for any other reason, an orange pin is placed opposite his name and the red pin is removed. When a man is breaking in on a job, a green pin is placed in the box under that job and a red lettered pin with it to show which schedule he is following while learning.

At the bottom of the board is a box in which is placed the shift schedule which shows which shift is working which schedule. Thus anyone can, by following the horizontal line opposite a man's name, determine whether he is working or breaking in and at what hours he is in or due in the plant. By following down the vertical lines under a job, anyone can determine not only which men are covering that job and on which shift they will be in, but also by noting the blue pins in that column what other men are able to work that job. This makes replacements easy and above all safe, because a blue pin is not placed on the board for a man unless he is fully capable of working the job.

The night foremen find the board particularly helpful as it eliminates unnecessary and useless calls at late hours.

The board not only shows which men need training and where they have not been trained, but by showing the jobs they are able to work indicates on just which jobs they are prepared and capable of being trained.

The board has proven particularly helpful in the past few years when men were moving from job to job and the refinery was operating under the stress of war. Even greater use and need for it is seen in the coming post-war years, which involve changes of scheduled hours, training programs necessitated by added shifts, and the filtering back into their old jobs or new ones of returning veterans.

Three men on the refinery staff worked up the plan for the schedule board—John Kesler, Jack Silsbee and Burt Colbert—and there is no doubt in their minds but what it can be enlarged to include all the answers to shift problems. They have also suggested that a similar plan could be worked out for the Maintenance Department, and would prove just as helpful.

Acknowledgment: This material originally appeared in *Pure Oil News*, Feb., 1946.

Wanted — IDEAS!

Plant operators, foremen and superintendents are invited to send in their own contributions of "how we do it around our refinery". Possible subjects could include maintenance and repairs ideas, inspection procedures, operating shortcuts — anything which has made your refinery more efficient and easier to run. Include photographs, drawings or sketches.

Material accepted for publication will be paid for at our regular space rates. Contributions should be addressed to:

Plant Practices Editor
National Petroleum News
Technical Section
1213 West Third Street
Cleveland 13, Ohio.

Permanent Buildings Taking a Big Share Of Funds for Bureau of Mines Program

WASHINGTON

The status of the program for the development and production of synthetic liquid fuels by the U. S. Bureau of Mines is revealed in the annual report to Congress by the Secretary of the Interior. The report covers the Bureau's activities during 1945 in coal hydrogenation, gas synthesis and recovery of liquid products from oil shale, as authorized by the Synthetic Liquid Fuels Act.

This act, Public Law 290, enacted in the spring of 1944, specifies that no more than $30,000,000 of public funds is to be authorized for the work and that the program is to run for not more than five years. Nearly two-thirds of this amount has already been spent or budgeted, the bulk of it on coal hydrogenation.

No spectacular developments are reported in any of the fields of study, most of the work having been directed toward setting up basic plant and equipment facilities. Main activities of the Bureau's Office of Synthetic Liquid Fuels, as detailed in the report, have been:

1) Construction at Bruceton, Pa., of new facilities for research and development work on the coal hydrogenation and gas synthesis processes; these facilities are scheduled for completion in 1946.

2) Establishment at Morgantown, W. Va., in the University of W. Virginia, of a laboratory to study methods of producing synthesis gases from coal and lignites.

3) Selection of Louisiana, Mo., as the site for 200 b/d demonstration plants for both coal hydrogenation and gas synthesis. Only preliminary flow diagrams and plot plans for the hydrogenation section and initial engineering work for the synthesis section have yet been prepared.

4) Construction at Laramie, Wyo., of new facilities for research and development work on the production of oil from shale, to cost $534,000 and be completed in the spring of this year.

5) Construction near Rifle, Colo., of an oil shale demonstration plant, expected to be in production this summer and ultimately to produce about 500 b/d.

6) Establishment, also near Rifle, of facilities for both selective and experimental mining of oil shale.

No information on expenditures and appropriations was contained in the report, other than the amounts of some of the contracts let for construction work. Some idea of what is being spent for various phases of the work, however, is revealed in the Federal Budget for the fiscal year 1947, recently submitted to Congress. These figures are presented in Table 1.

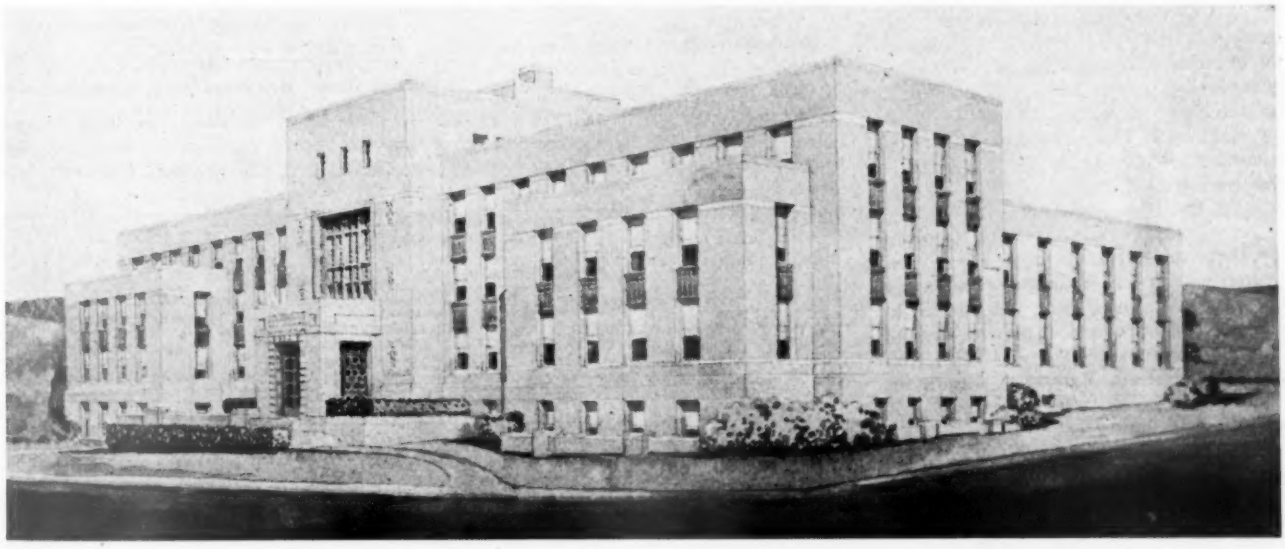
To carry out its program, the Bureau of Mines has set up seven divisions, as shown in Fig. 1, under the Office of Synthetic Liquid Fuels. The work of each of these divisions through 1945, as

TABLE 1—Budgeted Expenditures of Bureau of Mines for Work on Synthetic Liquid Fuels*

Project	Estimate 1947	Estimate 1946	Actual 1945	Accumulated Total
1—Hydrogenation and Gas Synthesis, Research and Development	$2,111,300	$2,776,069	$1,571,969	$6,459,338
2—Hydrogenation Demonstration Plant	2,115,495	2,696,660	.....	4,812,155
3—Synthesis:				
Research on Gas Production	183,780	172,000	36,810	392,590
Demonstration Plant	1,198,690	1,685,100	.....	2,883,790
4—Oil Shale:				
Research and Development	256,090	224,680	585,000	1,065,770
Mining	258,510	348,760	32,355	639,625
Demonstration Plant	876,135	1,090,130	370,467	2,336,732
TOTAL Obligations	7,000,000	8,993,399	2,596,601	.....
Transferred to Dept. of Agriculture**	.....	.....	410,000	410,000
1945 Balance Available in 1946	.....	−1,993,399	+1,993,399	.....
TOTAL Estimate or Appropriation	$7,000,000	$7,000,000	$5,000,000	$19,000,000

*As contained in the Federal Budget for the fiscal year 1947.

**For work on the production of synthetic liquid fuels from agricultural and forestry products, as provided in the Synthetic Liquid Fuels Act.



—Photos courtesy U. S. Bureau of Mines

This artist's sketch shows the $534,000 research and development laboratory being erected for the Bureau of Mines at Laramie, Wyo., for work on the production of oil from shale. This laboratory is expected to be completed this May

summarized in the report to Congress, was as follows:

Research and Development

The Synthetic Liquid Fuels Act and subsequent appropriations permitted expansion of the research and development work at Pittsburgh on the hydrogenation and gas synthesis processes for producing oil and gasoline from coal. New buildings to provide space for this work are being erected at Bruceton, Pa., about 15 miles south of Pittsburgh. Land for the site was owned by the government and is part of the property on which the Bureau of Mines' experimental coal mine is located.

New buildings include one for coal hydrogenation and one for the gas synthesis process, a machine shop and warehouse, power plant, and a number of smaller auxiliary buildings.

It has not been possible to maintain construction schedules. Major difficulties have been encountered in securing delivery and erection of structural steel, and delivery of brick and tile. Shortages of labor have been constant, and the end of the war has not relieved the situation.

At the present time foundations, erection of structural steel, roads, water and sewerage systems are being completed. Boilers are now in place. Schedules have been drawn up to make some buildings available for use this summer, and the whole project should be finished near the end of the year (1946).

To alleviate the effect on development work of the delay in the construction program, the facilities at Pittsburgh have been enlarged and other temporary quarters provided for the most important new research work.

Production of heavy fuel oil by hydrogenation of coal has been examined in the range of 1000 to 3500 psi. At the higher pressures the throughput was increased four times but hydrogen consumption also increased 25%. Experiments with coke packing in the hydrogenation converters have been conducted to determine if increased gas to liquid interface will decrease hydrogen consumption. This has been found to be the case but the coke packing also decreased the throughput.

Other investigations are being conducted on the coal hydrogenation process to eliminate centrifuging operations by substituting an inexpensive thickening operation to separate ash and pitch from the oil produced. Extensive studies are also under way to select the most suitable hydrogenation catalysts and to determine the important byproducts resulting from the process.

Experimental work on the gas synthesis process has been augmented in temporary quarters at Pittsburgh. A method is now being investigated for cooling the catalyst during the reaction of the gases on the surface to form oil. This method may greatly reduce the size and the cost of the convertors. The study of the catalysts used in this process has been carried far enough to outline the conditions which control the activity and life of the catalysts. Methods are being developed for direct measurement of the properties of the catalysts which do not depend on long-time tests in actual operation. It is believed that this work will lead to material improvement in the engineering and economic aspects of the gas synthesis process for producing gasoline and oil from coal.

Synthesis Gas Production

Both hydrogen and carbon monoxide gases are used in making oil and gasoline from coal The Synthesis Gas Production Division is developing the most economic methods for producing these gases from coal and lignite. This work is being conducted at Morgantown, W. Va., where the U. of West Virginia, through a cooperative agreement with the Bureau, is providing laboratory and office space. The staff is now being increased and full-scale investigation will be under way the early part of 1946.

The work to be carried out by the synthesis gas production division includes the preparation and testing of fuels and the design, installation, and operation of adequate gas-making, gas-purifying and gas-handling equipment. Through the use of existing information and by means of laboratory and pilot plant scale research, it is expected the finished gas can be made at lower than present cost.

Hydrogenation Demonstration

The purpose of work in the Hydrogenation Demonstration Plant Division is to carry the processes for the production of oil and gasoline toward commercial utilization. The first plant to be erected will be for coal hydrogenation.

An extended study was made to select the plant site which included a survey of 206 proposed locations in 21 coal-producing states. After the end of the war it became apparent, however, that some of the Government-owned synthetic ammonia plants used in the production of munitions would be closed down, and that they would offer an ideal location for the demonstration plant work. The War Dept., acting through the Quartermaster General, has made the synthetic ammonia plant at Louisiana, Mo., available to the Bureau. The Quartermaster General has a direct interest in the results of the Bureau's studies because he is responsible for the development and procurement of natural and synthetic fuels and lubricants essential to national defense.

The acquisition of the plant will result in a material saving in construction costs and will greatly speed the demonstration plant program. General facilities, such as offices, laboratories, boiler and power plant, water and sewage disposal systems, machine shop, roads and parking lot, railroad spurs, coal-handling and storage facilities, and cafeteria are available for immediate use.

Preliminary flow diagrams and plot plans are now being prepared for the erection of the coal hydrogenation plant at Louisiana, Mo. Initial design is based on about 200 bbls. of oil per day. This may be modified materially, either on the basis of the size needed to give the desired engineering and economic results or on the basis of the funds available for this demonstration plant.

Gas Synthesis Demonstration

The Gas Synthesis Demonstration Plant Division will also be in Louisiana, Mo. Engineering work for this plant is only in the initial stages and will not be completed until further information is available from the Research and Development Division at Pittsburgh and Bruceton, Pa., for the most suitable converter design.

The possibilities for improvement in this unit are so marked that it is desirable to have further results before construction of the gas synthesis demonstration plant is undertaken.

Oil-Shale Research and Demonstration

Laboratory development work on the production of oil from oil shale is being conducted in the Bureau's Petroleum and

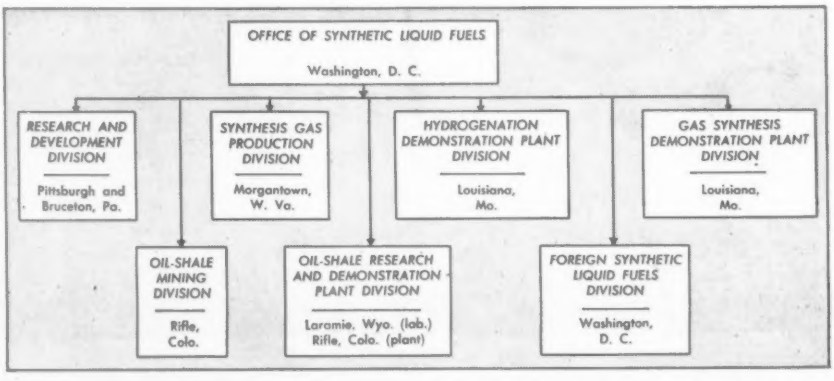
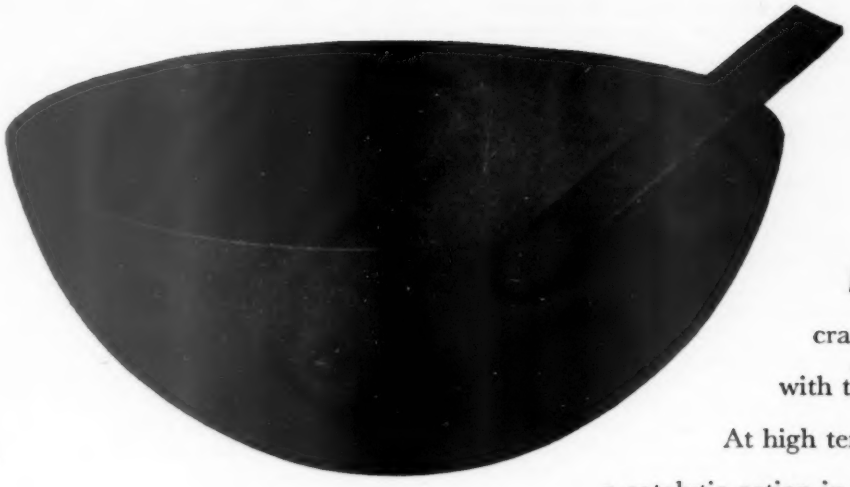


Fig. 1 -- Organization of the Bureau of Mines Office of Synthetic Liquid Fuels



Many refiners are degumming cracked gasoline distillate fractions with the help of ATTAPULGUS CLAY. At high temperatures, ATTAPULGUS exhibits a catalytic action in the presence of distillates carrying unsaturated, gum-forming hydrocarbons. It polymerizes these diolefins to higher molecular weight compounds, which are then readily removed by fractionation. The polymers of the gum-forming unsaturates are recovered and utilized commercially. Degumming is only one example of the many uses of ATTAPULGUS in finishing light distillates. It is used economically to neutralize, decolorize and dry kerosene after drastic treatment with a mineral acid.

ATTAPULGUS answers the gum question

And it is a dependable finishing and clarifying medium for such distillates as diesel oils, furnace oils, cracked or straight-run naphthas and gasolines, and their more closely fractionated components. Our engineers have wide experience in helping refiners develop finishing processes best suited to their needs. They know how easily and economically ATTAPULGUS CLAY can be applied to refining problems. They are always glad to discuss its applications. There's no obligation, of course. Just write

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(EXCLUSIVE SALES AGENT: POROCEL CORPORATION)

O.l-Shale Experiment Station at the University of Wyoming, Laramie, Wyo. The demonstration plant work on oil shale is near Rifle, Colo.

It is expected that the new buildings for laboratory work now under construction at Laramie will be finished in the spring of 1946. In the meantime, the Bureau has acquired a small building from the university and temporary offices and laboratories have been established.

The objectives of the program at Laramie are to develop process and engineering information necessary for the design, construction and operation of large pilot or demonstration plants for producing oil from shale and refining the oil into marketable products, and to provide basic technical data for the future oil-shale industry.

Studies are now being made of the assay of oil shale and improvements of methods of assay, determination of organic content and characteristics of oil shale, and study of specific heats and other properties important in design of oil shale retorts. Special attention is being given to the development of continuous retorts of high capacity for removing oil from oil shale.

Refining oil from shale presents special problems not met in refining petroleum and these are being studied. All of this work will be speeded materially with additions to the staff as soon as adequate space is available in the new laboratory building.

The site for the oil-shale demonstration plant is about 6 miles from Rifle, Colo., on Naval Reserve land. It is close enough to the Colorado River to provide water auxiliary facilities to serve the plant and for all purposes. The project comprises a retorting plant, camp for employes, and mine.

The retorting plant will provide for crushing, screening and retorting the oil shale, and for refining the product. The necessary facilities for this work are now being erected at the site, and it is anticipated that the production of oil will start in the summer of this year. Ultimate production will be about 500 b/d.

Rifle has a population of about 1500 and housing facilities were not available for the personnel of the oil-shale plant. Consequently, 50 houses are now being moved from the Bureau of Mines helium plant at Cunningham, Kans., which has closed since the end of the war, to the oil-shale plant.

Additional facilities for the oil-shale demonstration plant program, such as the water withdrawal system on the Colorado River, water distribution lines, sewerage system, and electric power distribution system, are being installed. It is believed that the entire project will be in operation during the summer of 1946.

Oil-Shale Mining Division

The oil-shale mine is about 2000 ft. higher than the retorting plant. Approximately 6 miles of road have been constructed over rugged mountainous terrain between the plant and the mine. The mine shaft and ventilation tunnel have been driven about 500 ft. to permit mining of oil shale for the retorting plant on relatively short notice. Additional mine studies are under way for the purpose of studying mining costs. These will be conducted on a large enough scale to develop the cheapest methods for drilling, blasting, loading and transporting the shale.

Foreign Synthetic Liquid Fuels Division

The work of the Foreign Synthetic Liquid Fuels Division derives directly from the investigation by the Technical Oil Mission. This latter group of about 30 oil technologists was in Europe from February through October of 1945, examining German synthetic plants and questioning the engineers and scientists.

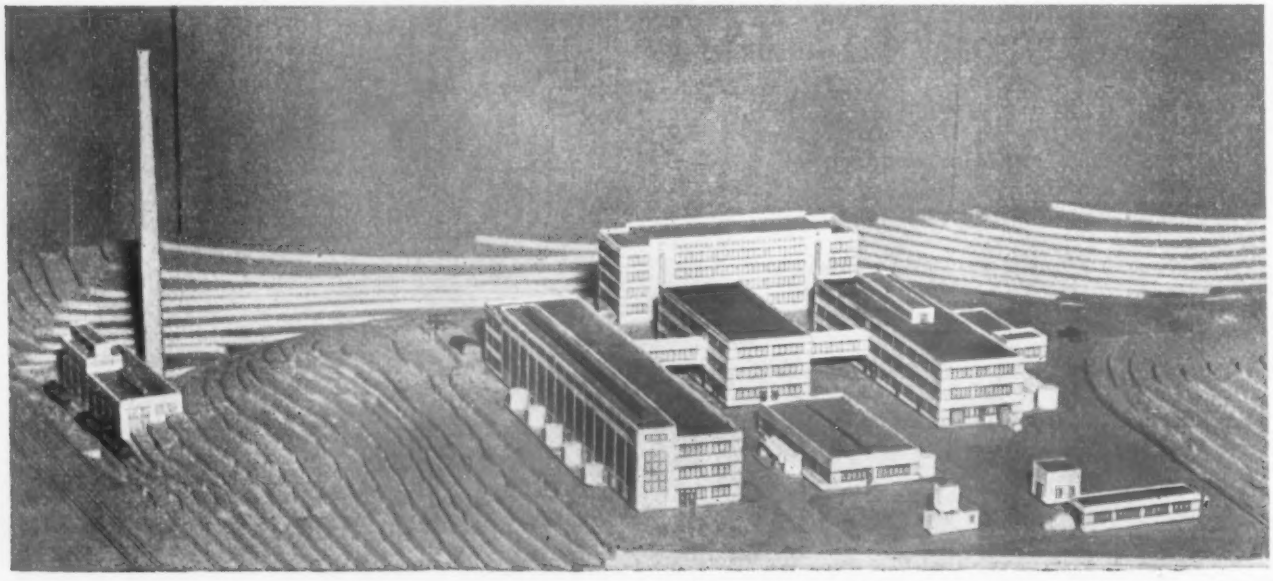
Microfilms of all important research and engineering documents that could be found have been shipped to this country for analysis and study. The Foreign Synthetic Liquid Fuels Division is handling this work with the aid of teams organized in industry, and reports are being prepared covering all phases of the German liquid fuels and lubricants industries.

Agricultural, Forestry Products

In addition to the work being done by the Bureau on the production of synthetic liquid fuels from coal and oil-shale, the Act which authorized the program also called for work to be done on obtaining those fuels from agricultural and forestry products.

This phase of the work is being carried on by the Department of Agriculture, to which the Interior Dept. has transferred $410,000 of its authorized appropriations. The work was inaugurated Nov. 1, 1944, the main project being a semi-industrial scale study of a process for the saccharification of agricultural residues for the production of alcohol and other liquid fuels.

Construction of a building for this work (costing $58,913) is underway and all special equipment has been ordered and much of it received. The process under study involves furfural production, xylose crystallization, and continuous dilute acid cellulose saccharification for the production of dextrose. The four intermediate products, furfural, xylose, dextrose and lignin, will be converted into liquid fuels through chemical and/or fermentation reactions.



Architect's model of the laboratories being built at Bruceton, Pa., for the Bureau of Mines research and development work on the coal hydrogenation and gas synthesis processes. At the extreme left is the power plant. Of the three connected buildings forming the main plant area, the left one will be used for work on hydrogenation, the right for work on gas synthesis, and the center for shops, offices and storage. The building in the background has been omitted in later plans

Refinery Waste Disposal Problems Handled in Special Laboratory

By
William F. Bland
Engineering Editor
NPN Technical Section

A laboratory with only one job. That's a thumbnail description of the Waste Control Laboratory at Atlantic Refining Co., which has the sole responsibility of learning how to handle refinery wastes efficiently.

Because of the growing importance of this phase of refinery operations, NPN assigned one of its technical writers to visit the laboratory and report on it for the benefit of the entire refining industry.

The way in which the laboratory staff tackles its job, the equipment it has to work with, how the laboratory came into being and grew to its present size, and its future program are all told below—in an exclusive NPN TECHNICAL SECTION feature.

TO LEARN what industrial wastes its refinery is producing, what their toxic effect will be when discharged into surface waters, and how they can best be disposed of, the Atlantic Refining Co. has set up a unique Waste Control Laboratory.

It is said to be the only laboratory of its kind in existence in the petroleum refining industry. It devotes its efforts entirely to the study of refinery waste control and allied problems.

Operating at Atlantic's Philadelphia plant, the Waste Control laboratory is completely distinct from any of the refinery's other laboratories. It has its own full time staff, including a registered sanitary engineer, and its own equipment and facilities, including chemical and bacteriological units.

Main duty of the laboratory staff is to determine the wastes being produced in the company's refineries, the degree of treatment required to make them disposable, and the most economical and feasable method of treatment.

The work of the Waste Control Laboratory doesn't stop there, however. In addition to the primary job outlined above, its staff pursues the following functions:

(1) Develops the equipment to be utilized in waste treatment and draws up functional designs, which are in turn passed on to the engineering department for structural design and construction.

(2) Supervises the operation of waste control and disposal facilities, and provides operating instructions and control procedures.

(3) Suggests, for further investigation by the company's research and development staff, various wastes which might economically be recovered or utilized.

(4) Conducts investigations, collects data and performs analyses for required reports to federal and state agencies on the company's waste disposal.

(5) Performs limited fundamental research on the basic principles of waste disposal and the toxic effects of wastes on aquatic and other forms of life.

(6) Assists in the work of the American Petroleum Institute's Committee on the Disposal of Refinery Wastes.

Began 15 Years Ago

Atlantic's Waste Control laboratory had its conception about 15 years ago, shortly after the American Petroleum Institute began its nation-wide survey of oil-pollution conditions in the United States.(1)

W. B. Hart*, superintendent of Atlantic's Gas, Acid and Drainage Department, was a member of the API committee which undertook that investigation. As a result of the work and because he already had an interest in biology, he decided to embark upon some investigations of his own to determine the toxic effect of various wastes.

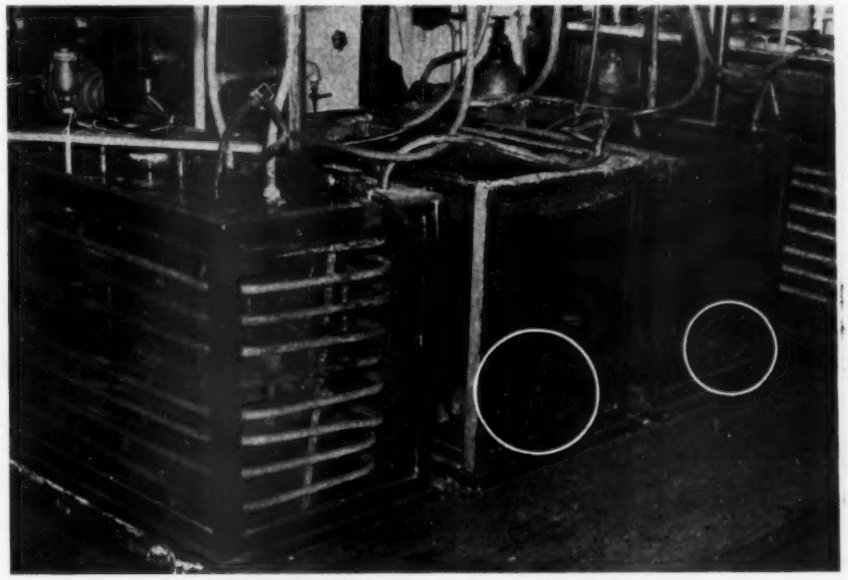
With company approval he set up his first "laboratory"—if it could be called that—in a corner of the one-room office of his department. At that time his main pieces of equipment were two aquariums with a few fish which he used for toxicity tests. He had no method for controlling the temperature or oxygen content of the water in his test tanks.

Shortly after that the laboratory was "expanded"—although its realm was still confined to one corner of the office. A table and glassware for making odor determinations were added to the equipment.

Thus, the earliest attempts of the laboratory at waste control were to determine the effects of discharged waste on aquatic life and on the odor and tastes of surface waters.

It was in the first laboratory, too, that Mr. Hart began to develop his ideas for

*W. B. Hart is author of the general series of articles on "Disposal of Petroleum Refinery Wastes" currently appearing in the NPN TECHNICAL SECTION.



Fish are the guinea pigs in the Atlantic laboratory, where they are used to test the toxicity of wastes in terms of what concentration of waste kills just half of a batch of fish within a given time period. The two tanks to the right are for storage, while the left tank is used to acclimatize the fish to the temperature and quality of water in which they will later be used for test work. Sunfish, obtained from the Pennsylvania state fish hatchery, are used for most tests

an oil-water separator, which later became the API oil separator.[2]

Along about 1935 the laboratory began to come into its own. A full-time civil engineer was hired to handle its expanding activities (which up to then had been carried on by Mr. Hart in his spare time), and it was set up in a separate room by itself.

The equipment also began to expand. Facilities were provided for performing chemical analyses and a small pilot plant for treating wastes was built to determine the ability of municipal water treatment plants to handle wastes disposed of by up-stream refineries.

In 1939 a trained sanitary engineer replaced the civil engineer, bringing to the laboratory specialized training in the fields of water supply, waste disposal and stream pollution.

At the same time the physical facilities began to blossom out. The laboratory was augmented by a second room—a bacteriological laboratory. A year later, 1940, an enlarged chemical laboratory was set up in a third room; and in 1941 an office and conference room was added.

Today the laboratory occupies 1500 sq. ft. of floor space and has a staff of three full-time employes—a registered sanitary engineer, a graduate biologist-chemist, and a laboratory technician.

In the near future, to meet the increasingly rigid requirements of waste control and disposal, it plans to expand into new quarters which will more than double its physical facilities and to double its staff by adding an assistant sanitary engineer, another chemist and a second technician.

Fish are Guinea Pigs

Any laboratory seeking to determine the effects of some particular matter on life must have guinea pigs. And so it is with Atlantic's Waste Control Laboratory—except that its guinea pigs are fish.

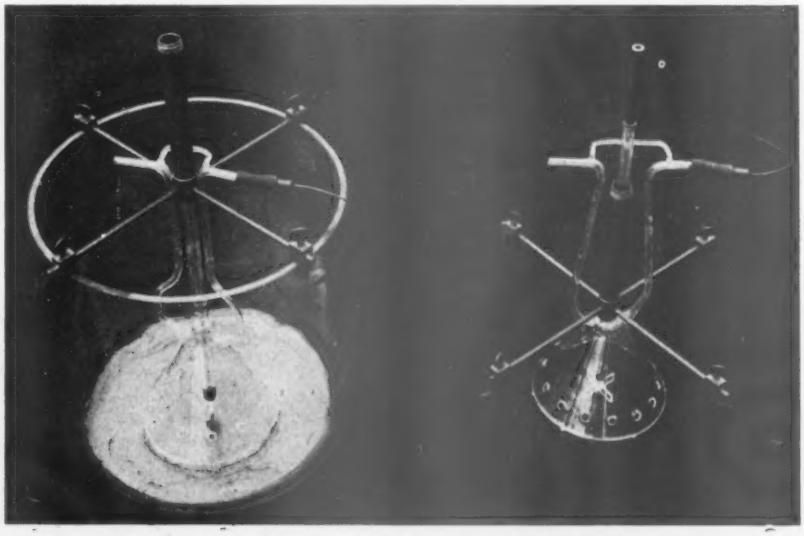
One whole room is set apart for its work with fish and is known as the fish laboratory. These animals are used to determine the toxic effects exerted by various chemicals and wastes, as evidenced by the concentration of waste in water which will kill exactly 50% of a given number of fish within a definite period of time.

The toxicity tests are conducted by

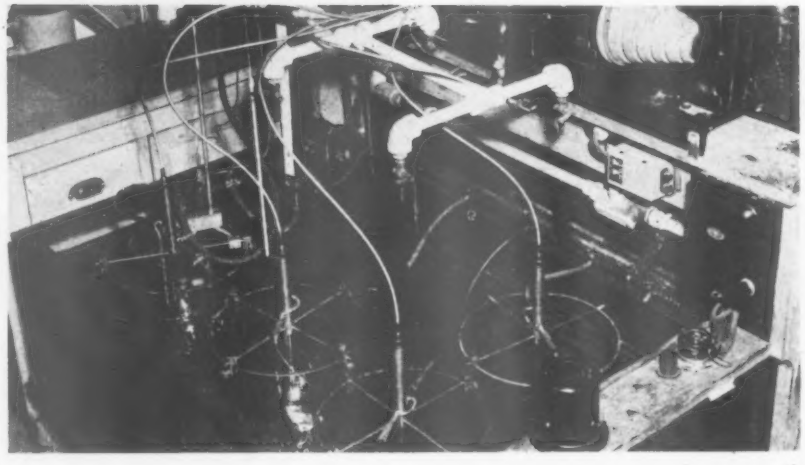
Special Equipment Designed for Waste Control Laboratory

Much of the equipment used in the Atlantic Waste Control Laboratory is designed and built right in the laboratory, such as the reoxygenation apparatus shown in the accompanying photographs. This equipment is used for adding oxygen to water during toxicity tests, to replace the oxygen used by the fish in the test jar. Normally, oxygen is added by bubbling air up through the water in the jar. This procedure isn't practical, however, when a volatile waste is being tested. The agitation caused by the bubbling air would release a part of the waste material and influence the test results.

To eliminate this agitation, the reoxygenation apparatus was designed. It maintains a pure oxygen-water interface in the inverted funnel, the oxygen being absorbed into the water without agitation because of the difference in vapor pressure. In operation, pure oxygen is admitted through the glass tube at the left and is trapped in the inverted funnel. The glass tube at the right is attached to a capillary tube, which bleeds off enough oxygen to keep a steady flow of the gas through the apparatus, preventing air lock or pressure binding. The oxygen is fed at a definite controlled pressure, so that a constant level is maintained in the funnel. Water is circulated under the interface by means of a small glass paddle, rotated by a flexible speedometer cable running through the funnel stem. In most cases a larger paddle than shown is employed. The water is circulated through the holes in the funnel, and also beneath the funnel, which is held off the bottom of the jar by small glass beads fused to its lip.



ABOVE—Closeup view of the special reoxygenation apparatus designed for adding oxygen to water during toxicity tests without agitating the water. Shown are the equipment in position in the 5-gal. test jar (left) and by itself. This special apparatus is employed only when a volatile waste is being tested. Usually oxygen is supplied by bubbling air up through the water, but the agitation caused by this procedure would release part of the volatile wastes, affected the test results



RIGHT—One of the constant-temperature tanks in which toxicity tests are run, showing the reoxygenators in the test jars and connected to the cable which revolves the paddles

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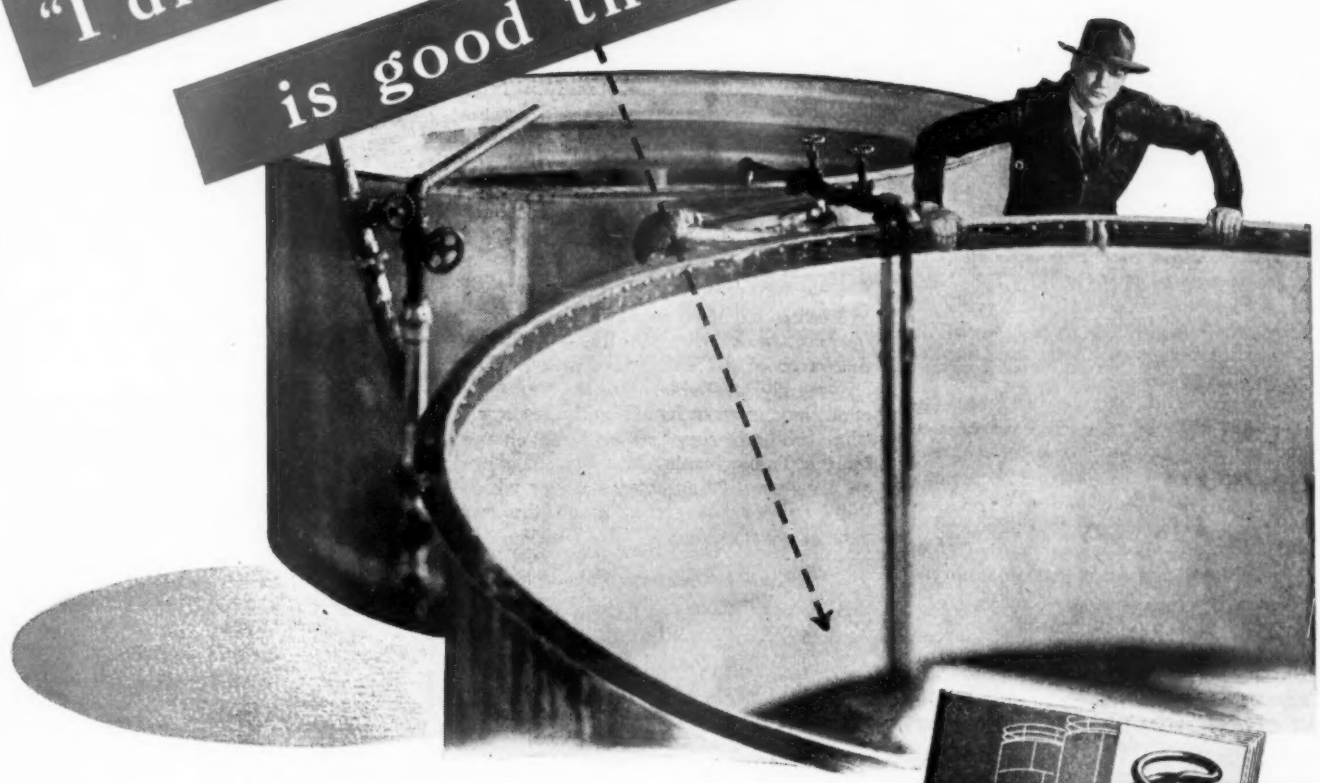

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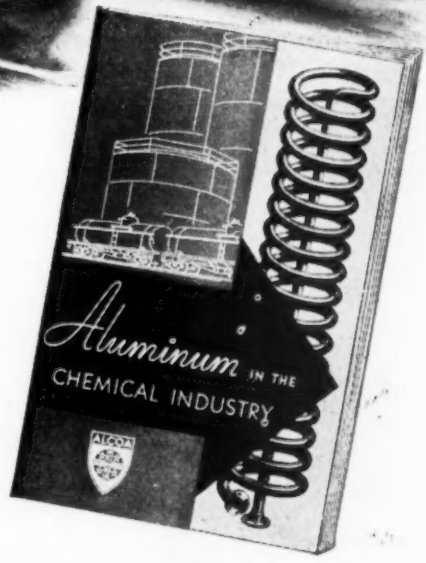

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placing 10 fish in a jar containing a known concentration of waste water. If at the end of 24 hr. less than five of the fish are dead another test is run with a higher concentration of waste; if more than five are dead a lower concentration is used—until it is determined what concentration kills just five of the fish. Similar tests are run at 48 and 96 hr. intervals.

Any fish surviving a test are not used for any similar test, since they tend to build up an immunity to the toxic matter under investigation.

This type of toxicity test has been developed in the Atlantic laboratory to give more dependable results than could be obtained with former methods, which were based on the time required to kill all the fish. This older method wasn't reliable, Atlantic engineers claim, because one particularly healthy fish, better able than his fellow fish to withstand the toxic conditions, could upset the entire test results by living until he died of lonesomeness.

Conditions of all the tests are kept constant. Five-gal. glass jars (12 in. deep and 12 in. diameter) are always used, and the water in them is kept at a constant temperature—20 or 25° C.

The amount of oxygen dissolved in the test water must be maintained above a minimum of 4 or 6 ppm to approach normal conditions. A lower dissolved oxygen content may increase the effect of the toxic condition, according to Atlantic's waste engineers. This oxygen content is maintained in two ways.

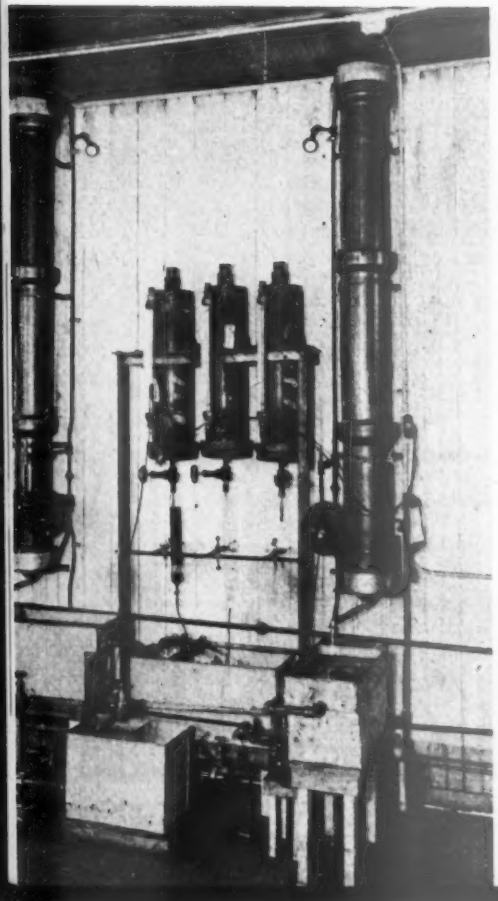
(1) Bubbling air up through the water (air diffusion) or

(2) Maintaining a pure oxygen-water interface, the oxygen being absorbed into the water.

This second method is employed when the waste material dissolved in the water is of a volatile nature—the type which would gradually leave the solution upon standing. The turbulence caused by the air-diffusion method would accelerate the loss of such wastes and upset the results. To maintain the pure oxygen-water interface a special device has been developed in the laboratory, as explained and illustrated in the boxed text and photographs on the preceding page (R-178).

Sunfish are used in most of the tests, because, as described by Roy F. Weston, in charge of the entire laboratory, "they are readily available, sensitive to toxic conditions, easy to handle and not scary." The fish are supplied without charge by the Pennsylvania state fish hatchery on a cooperative agreement under which the hatchery has access to all the test data of the laboratory.

Special and unusual equipment is common throughout Atlantic's Waste Control Laboratory. This small pilot plant unit is used for research work on the biological filter treatment of waste caustic



Other Laboratory Facilities

Although the fish laboratory is the most interesting of the facilities in the Atlantic Waste Control Laboratory, there are two others which are just as important and necessary to the work being done there—the bacteriological and chemical laboratories.

The bacteriological laboratory has the usual specialized apparatus that you'd expect to find in that type of a unit—steam pressure autoclave for sterilization of culture medium and equipment, dry heat autoclave for sterilizing glassware, incubators, ordinary and widefield microscopes, and a colony counter for determining the bacteriological content of a given sample.

In addition to the usual chemicals and glassware, the chemical laboratory has a special odor determination room, relatively air conditioned, which is used to measure the amount of dilution required to make the odor of a waste just barely perceptible.

Extensive Study Being Planned

An intensive study of the entire waste disposal problem at Atlantic's refineries is now being planned by the laboratory, and is expected to require about two or three years to complete. This study is in line with an active program of waste pollution abatement being undertaken by various state authorities.

As part of this study, the laboratory plans first to make a complete field survey of all process units in the various plants, to determine roughly what wastes are being produced, and where and in what quantity they are being discharged. That survey will be made with the help of the operating department, but won't be too detailed.

After that, an exact analysis will be made of the conglomerate wastes at the various points where the refinery sewerage lines discharge into public waterways. These analyses will be made to find out exactly what wastes are present and whether or not they require treatment before disposal, and will be concerned with such items as the following:

(1) pH (degrees of acidity or alkalinity),

(2) Toxic conditions (e.g. lead or organic nitriles) which might be harmful to aquatic or human life,

(3) Chemicals which may affect the taste or odor of a public water supply,

(4) Oxygen consuming materials (e.g. sewage, organic acids, phenols, mercaptans—mostly biochemical and chemical),

(5) Oil and other floating matter, and

(6) Dissolved and suspended solids (brines and salt solutions, coke, ash, catalyst).

Once the wastes requiring treatment are singled out, the laboratory staff, with the aid of earlier analysis of the entire refinery operations, will locate the sources of the troublesome materials. If possible and practical, the waste might be eliminated by a change in the process. If that can't be done, the laboratory staff will then figure out how to treat the material most efficiently. They will also determine whether to treat the waste at the process unit or at some other point in conjunction with an accumulation of other wastes.

Once the desired treatment is decided upon, the staff will draw up designs and specifications for the waste control or treatment equipment, and turn them over to the engineering department for structural design and equipment.

* * *

At the beginning of this article the statement was made that Atlantic had the only waste control laboratory in the refining industry. That remark wasn't intended to imply that no other refineries paid attention to laboratory control of their waste disposal problems.

Other refineries do carry out laboratory analyses of wastes and of control methods. The Atlantic laboratory, however, is the only one which devotes itself solely and entirely to the full-time job of handling waste control and disposal problems.

References

(1) Stroop, D. V., "Progress in Waste Disposal," *API Quarterly*, July, 1945.

(2) Hart, W. B., "Elements of Waste-Water Separator Design," *Proceedings API*, 19M (III) 8 (1939).

(From a Secret Report of the Manager of Edeleanu in Germany)

Some Solvent Extraction Developments in Germany

Translated and Edited
By J. PAUL JONES
Member U. S. Technical Oil Mission to Germany

Article 2: Separation of L-T.C. Tar Distillate into Raffinate and Extract; Use of Naphtha to Separate the Extract

Highly confidential information on work in Germany on solvent extraction methods for oil recovery was obtained from an important document discovered by a team of American and British scientists, on a mission to Altenburg. The document was a report by the manager of Edeleanu G.m.b.H, which pioneered among industrial organizations in solvent extraction methods as applied to petroleum refining. The report discusses a commercial installation in Germany operating on tar distillate recovered from low-grade brown coal. It also describes the use of the triangular coordinate graph technique to supply data on the relationship between solvent, raffinate and extract phases necessary for commercial operations.

The German document has been translated by J. Paul Jones, a member of the Oil Mission and included in a report on solvent extraction of the U. S. Technical Oil Mission to Germany. It has been edited especially for the NPN Technical Section by a member of the mission. The report is being published in four instalments, the first appeared in the Feb. 6, 1946, issue, pg. R-83.

Separation of Tar From Low-Temperature Carbonization of Brown Coal Into Tar SO_2—Raffinate and an SO_2 Extract

REFERENCE should be made back to the boundary curve for L-T.C. (low-temperature carbonization) tar distillate.(a) The curve shown in Fig. 7 was obtained at 40°C. We have already learned to determine from it the initial mixture of oil and solvent, the amounts of the respective extract and raffinate solutions, and also the characteristics of the solvent-free raffinate and extract. Still more can be obtained, however.

The goal of the extraction is to obtain from the charge stock, under the stipulated conditions, the best raffinate (from the lower left hand part of the curve) and the extract with the highest specific gravity. If these two points are joined by a line, the point where this line intersects the charge-stock line, as we have already seen, indicates the amount of charge stock and of solvent necessary for this separation; in this case about 100 parts by weight of oil and 250 parts of solvent.

We already know that such a separation into this raffinate and an extract of maximum specific gravity can only result from a plurality of stages. Further, we can determine the theoretical number of stages for such a separation as the characteristics of extract and raffinate solutions in each stage. The basis for such a determination can be obtained by construction.

It is clear that the sum of the charge stock plus solvent is equal to the sum of the raffinate plus extract solutions, since the latter result from the first two. Expressed differently, in a given unit of time the amounts of raffinate and extract solutions removed from the extraction system are equal to the amounts of charge stock and solvent entering the system. Furthermore, the two amounts of liquid which flow counter-currently through a single cross section of the extraction system, in a given unit time, have a simple straight-line relationship. At the extract side the final extract solution flows out and the charge stock in. At the raffinate side the final raffinate solution flows out and the pure solvent in.

Accordingly, the final raffinate solution (at the left branch of the curve) and the pure solvent (top of the triangle) should be considered together, as should the solvent-free charge stock (intersection of the charge-stock line with the base of the triangle) and the final extract solution (point of tangency on the boundary curve). If these points are joined, two lines are obtained which intersect outside the triangle at the point S. This is the case not only for the end stage, but also for each intermediate stage of the extraction.

If, for each of the intermediate stages, the numerical value is experimentally determined for each intermediate raffinate solution which comes into each stage for separation in admixture with the extract solution from the preceding stage and, similarly, the numerical value is deter-

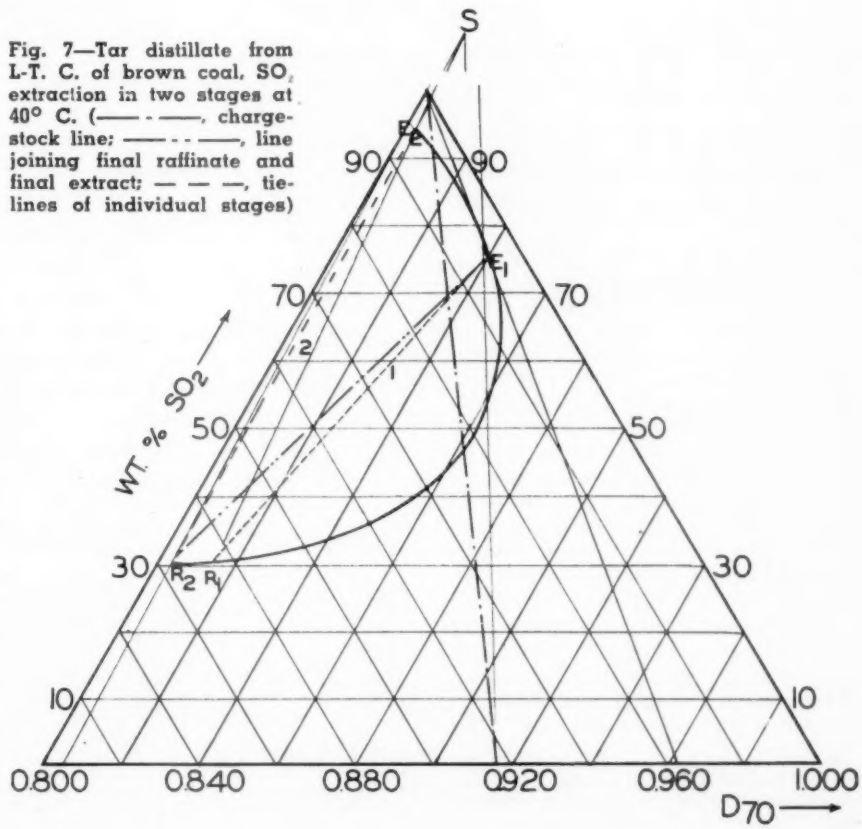


Fig. 7—Tar distillate from L-T. C. of brown coal, SO_2 extraction in two stages at 40° C. (——·——, charge-stock line; ——··——, line joining final raffinate and final extract; — — —, tie-lines of individual stages)

(a)—Fig. 1, NPN Technical Section Feb. 6, 1946, pg. R-85.

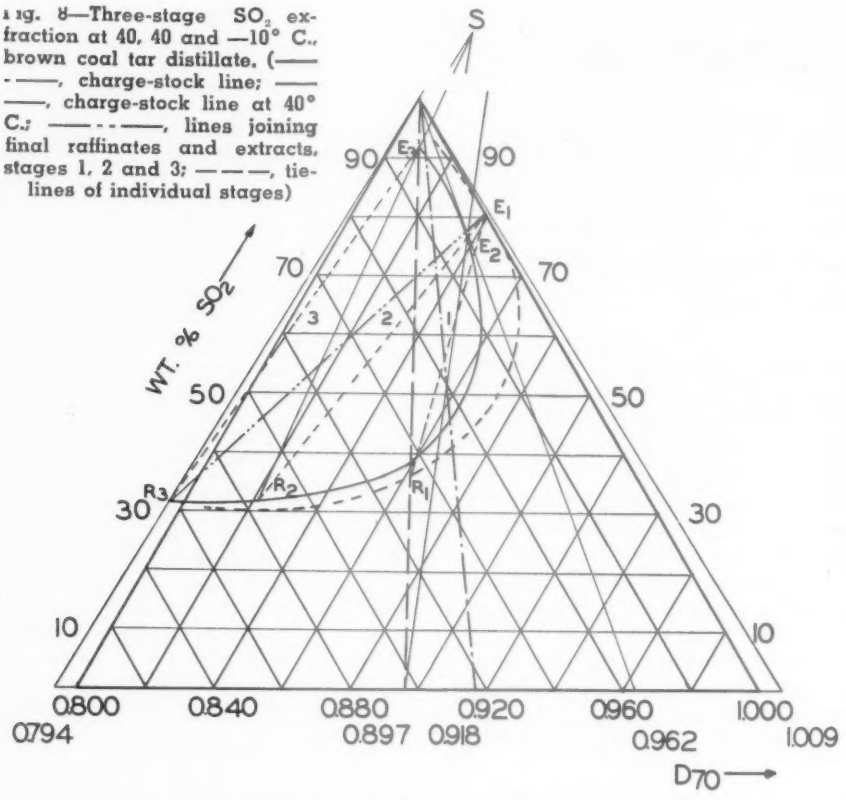


Fig. 8—Three-stage SO_2 extraction at 40, 40 and —10° C., brown coal tar distillate. (—— - ——, charge-stock line; —— ——, charge-stock line at 40° C.; ——- - ——, lines joining final raffinates and extracts, stages 1, 2 and 3; — — —, tie-lines of individual stages)

mined for the resulting extract, and if these two points are joined by a straight line, an extension of this straight line also passes through the point S. This fact has a mathematical basis, and it can be demonstrated that it must be so. For the present, however, it is enough to know that it is so.

Accordingly, the point S can always be determined from the points for the final raffinate solution and the apex of the triangle, the first extract solution and the point of intersection of the charge-stock line with the base of the triangle. Furthermore, with the point S, it is theoretically necessary to obtain a desired final raffinate and extract from a given amount of charge stock and of solvent.

A counter current extraction takes place in the manner now to be described. The penultimate extract E_2 and the charge stock are mixed in the first stage, and there is then separated a final extract E_1 and an intermediate raffinate R_1. This intermediate raffinate is defined by the tie-line corresponding to the final extract. In the second stage this intermediate raffinate R_1 is mixed with the intermediate extract passing from the third stage[b] and similarly there is likewise separated a raffinate and an extract (i.e. the penultimate extract just mentioned).

The location of the point representing this extract on the boundary curve is as yet unknown; however it is known that it must be the point of intersection of the boundary-curve and the line joining this intermediate raffinate with the point S. If this point is determined in this manner, the tie-line of this point again indicates the corresponding raffinate, and a determination of each succeeding point may be made in the same manner.

It can be seen that by an isothermal extraction of L-T.C. tar distillate at 40°C. it is possible to separate it in two stages and, with a given ratio of charge stock and solvent, into the best possible raffinate and the extract with the greatest density. This is discernible from the divergence of the tie-lines. The more markedly the tie-lines diverge, the greater is the extraction effected in each stage and the fewer the stages necessary to obtain the best possible separation.

In actual practice the extraction is carried out with a temperature gradient as well. Thus a final extract obtained at 40°C. can be further separated by cooling to a lower temperature. This is shown in Fig. 8. This distillate is separated at 40°C. and at —10°C. For this purpose a boundary curve for —10°C. is drawn. The extract with the highest density is determined from the point of tangency with the boundary curve of a line drawn through the apex of the triangle.

The separation of the L-T.C. tar is carried out in three stages: A first stage at —10°C., from which the final extract is obtained and to which the charge stock is added[c] and extracted by admixture

(b)—As will be seen from the discussion following, there is no third stage with L-T.C. tar, since the intermediate raffinate R_1 is separated by the pure solvent (SO_2) into E_2 and R_2.

(c)—As is apparent, the results of the —10° stage can be obtained in two ways, either by cooling the final extract of the 40° stage or by simultaneous introduction of the charge stock into the —10° stage whereby the material in admixture with the extract from the 40° stage, is separated into a final extract (—10°C) and an intermediate raffinate.

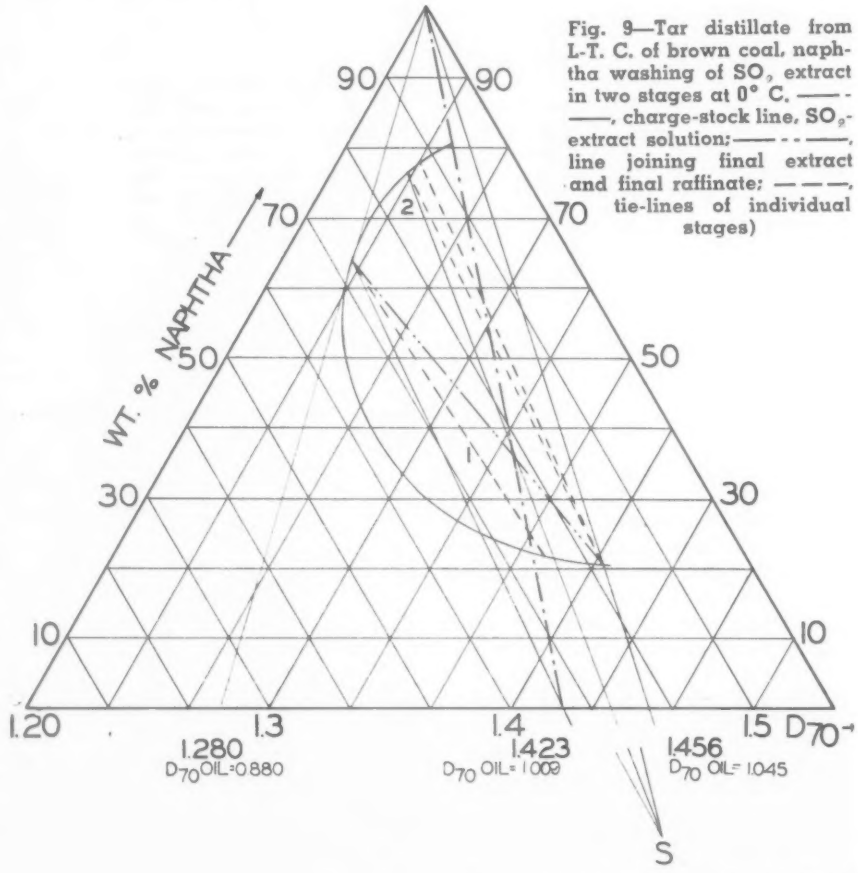


Fig. 9—Tar distillate from L-T. C. of brown coal, naphtha washing of SO_2 extract in two stages at 0° C. ——- - ——, charge-stock line, SO_2-extract solution; ——- - ——, line joining final extract and final raffinate; — — —, tie-lines of individual stages)

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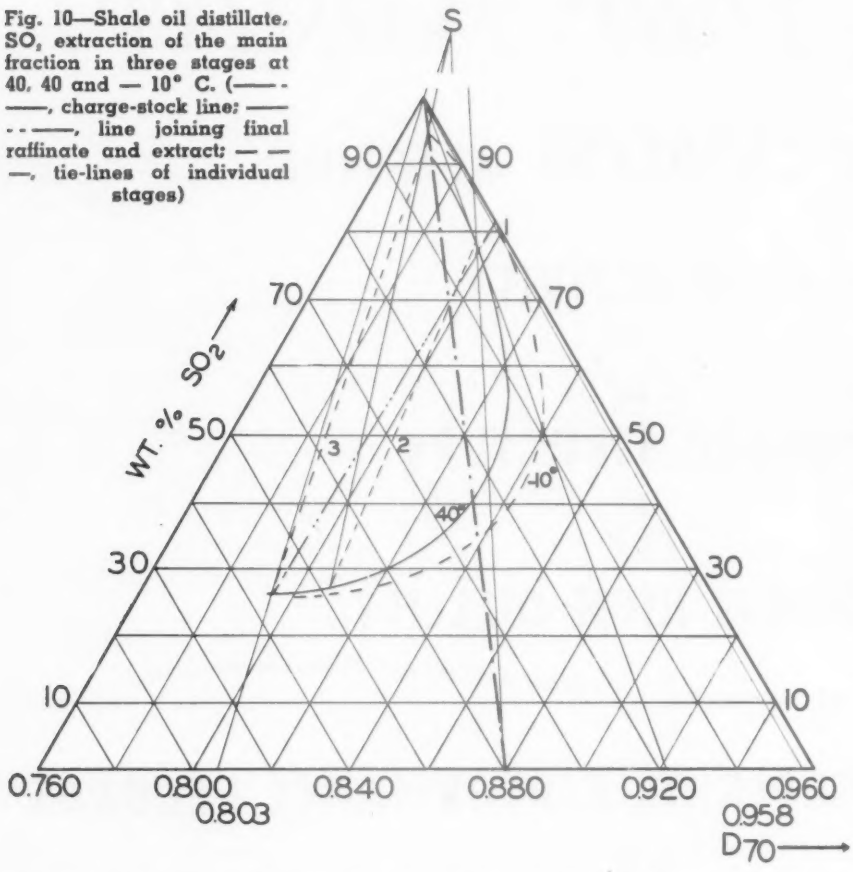


Fig. 10—Shale oil distillate, SO_2 extraction of the main fraction in three stages at 40, 40 and — 10° C. (——·——, charge-stock line; ——··——, line joining final raffinate and extract; — — —, tie-lines of individual stages)

with the final extract solution from the stages operated at 40°C., and two other stages operated at 40°C. The pure solvent is charged to the third stage, from which the final raffinate solution is obtained.

Use of Naphtha to Separate an SO_2-Extract from a Tar from Low-Temperature Carbonization of Brown Coal

The part of the raffinate material which still remains in the extract from the extraction at −10°C. is removed by washing the extract solution with naphtha. In commercial operations the wax-free middle-oil distillate is also treated with the naphtha wash and is separated into a raffinate and an extract. As a result, the extract relationships are somewhat more striking in this naphtha wash. In the present situation this is disregarded and only the final extract from the −10° stage is extracted with a low boiling naphtha fraction, without first removing the solvent (SO_2). The boundary curve for this part of the total separation procedure is also shown, not at −10°C. but instead at 0°C.; as a result the density (D_{70}) of the final extract is somewhat lower, i.e. 1.045 instead of about 1.060.

Fig. 9 shows the boundary curve of the naphtha wash. This curve lies with the two-phase area to the right and the raffinate part of the curve is on top. The base of the triangle represents the density (D_{70}) of the SO_2-containing solution and the apex the pure solvent—in this case naphtha. In this extraction procedure the result is a removal of residual raffinate material from the SO_2-extract.

This naphtha extraction differs from the previously described SO_2 extraction in that the naphtha solvent goes into the raffinate and also in that the charge stock—the final SO_2-extract dissolved in SO_2—is introduced in the top of an extraction tower and flows from top to bottom counter-current to the upflowing lighter naphtha. At the lower end of the extraction system the extract of the naphtha wash is discharged and the solvent (naphtha) is introduced, contrary to the SO_2 extraction, while at the upper end the raffinate solution is discharged and the charge stock is introduced. The upper part of the curve represents the raffinate solutions and the lower part the extract solutions.

The raffinate with the lowest density is found from the tangent to the curve which passes through the apex of the triangle, while the extract with the highest density lies at the right hand outer end of the lower branch of the curve. In contrast to SO_2 extraction, the use of a large amount of solvent results in an extract of high density and a raffinate which contains a large amount of extract material. The use of a small amount of solvent results in a raffinate of low density and an extract with a large amount of raffinate material.

In contrast to the previously described SO_2 extraction, by removal of solvent it is possible to effect a separation of a given raffinate solution into a new raffinate solution (a raffinate with a lower density than that of the charge solution) and an accompanying extract solution (an extract with a corresponding density). Similarly, by treating an extract with an increasing amount of solvent the density of the extract can be increased. These special characteristics produce the location and form of the boundary curve.

In this extraction pure solvent and final extract come together in the lowest stage. At the opposite end of the extraction system (upper part of the extraction tower) the solution of final raffinate in naphtha leaves the system countercurrent to the entering SO_2 solution of the extract, i.e. the charge solution. In order to determine the point S a line is drawn through the point on the base of the triangle corresponding to the charge stock and the point of tangency on the boundary curve (of a line through the apex), i.e. corresponding to the final raffinate, and a line is drawn through the point corresponding to the final extract and the apex of the triangle (representing the pure solvent). These two lines intersect in the point S.

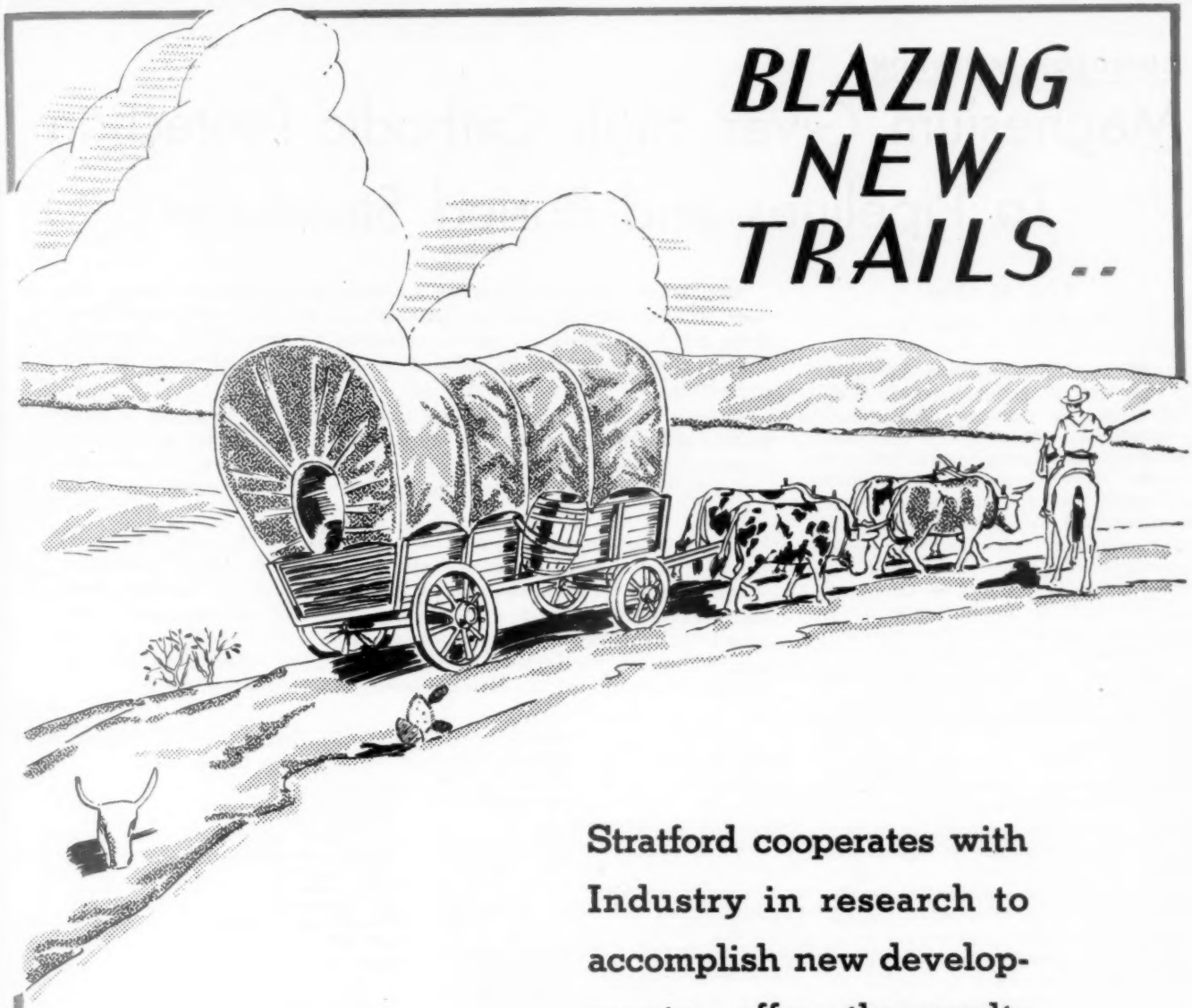
The naphtha raffinate is the second and heavier Diesel oil product. These Diesel oil products will be designated by "I" in the following discussion. With a simultaneous extraction of the neutral oil in this naphtha wash and a decrease of the extraction temperature to −10°C., the density of the naphtha raffinate is lower, and the resulting amount of raffinate is increased. The simultaneous use of neutral oil results in the introduction of lower boiling components in the naphtha raffinate. A flow sheet for commercial operation will be presented in a later article in this series.

Separation of Shale Oil Distillates with Liquid Sulfur Dioxide

Before we go into a consideration of dewaxing, which is the same for L-T.C. tar and for shale oil, we will consider briefly the boundary curve for the SO_2 extraction of shale oil (Fig. 10). This extraction is also carried out in two stages at 40°C., and in a subsequent stage at −10°C. From this extraction is obtained a final raffinate with a density $D_{70}=0.803$ and a final extract with a density $D_{70}=0.958$. This corresponds to a raffinate yield of 50.3% from the wax-containing fraction. A complete discussion of the separation of shale oil will be presented later.

German Solvent Dewaxing

Both hard and soft wax were obtained commercially in Germany during the war by solvent treating the tar distillate obtained from the low-temperature carbonization of brown coal. Details of the dewaxing process are described in the third instalment of "Some German Solvent Extraction Developments", to appear in the April 3d issue of the NPN Technical Section. Properties of the waxes are given from inspection data.



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Magnesium Gives High Cathodic Protection To Pipelines and Buried Structures

By L. M. Oldt
The Dow Chemical Co.

Magnesium—yesterday's wartime industrial metal—today is finding new uses in the petroleum industry. Underground pipelines and metal structures are being guarded against corrosion by expendable magnesium anodes buried in the nearby soil and employing the principle of cathodic protection.

Greatly increased equipment life is predicted. For example, a flume built of steel piling driven 14 ft. into the earth was expected to withstand corrosion for only five years. Magnesium anodes installed for cathodic protection have extended that life expectancy for an indefinitely long period.

Certain magnesium alloys, as described in this article, have been found to offer superior properties as galvanic anodes for this type of protection. When properly installed, as much as 500 ampere hours of electricity have been realized per pound of magnesium consumed at the anode, compared, for example, with 373 ampere hours for a zinc anode. Longer life and efficiency of the magnesium anodes have been achieved by developing new types of backfill—the electrolyte used around the anode.

THE problem of corrosion prevention has long engaged the interest and effort of pipeline operators, ship owners, engineers and others directly concerned with this troublesome manifestation of nature. Numerous experimental methods of various types have met with success, but no 100% satisfactory solution has yet evolved for combatting this costly phenomenon. One of the newest and most promising methods to be experimented with thus far is the use of expendable magnesium anodes employing the principle of cathodic protection.

Although Sir Humphrey Davy first suggested the use of cathodic protection in 1823 only in recent years has it come to be widely adopted. There are two types of anodes in use today, galvanic and electrolytic. The galvanic anode, composed of a metal higher in the electromotive series than the metal to be protected (e.g. magnesium is higher than iron), has the advantage of operating automatically. The electrolytic anode, however, must be energized by an external D. C. voltage, this current being supplied by rectifiers, motor generator sets, windmill generators and similar devices. The necessity for utilizing some external source of power may add to the cost of protection.

For some time magnesium has been recognized as a desirable material for use in cathodic protection installations inasmuch as it combines in one metal a large storage capacity for electricity and a high potential or driving voltage, both desirable characteristics when the anode is to operate galvanically. Theoretically, the storage of electricity in magnesium is 1000 ampere-hours per pound. This is a larger storage capacity than is realized with any other metal having a comparable driving voltage, with the single exception of lithium. Zinc for instance is capable of supplying only about 373 ampere-hours per pound of metal consumed. The voltage developed between magnesium and iron on open circuit is about 1.0 volts or approximately twice the voltage obtained with zinc-iron couples. A further property of magnesium which recommends its use as an anode in cathodic protection is the fact that it shows little or no tendency to polarize.

Realizing the potential advantages of magnesium in this new field, the Dow Chemical Co. about 6 years ago began a program of laboratory research and field installations to determine methods of obtaining higher current efficiency and to ascertain how magnesium metal would perform in its role of galvanic anode. The war demands on magnesium interrupted this program but the work was resumed as soon as magnesium again became available. All the laboratory work in this investigation was done at **Midland, Mich.**, while most of the field work was carried out by the Texas Division at the Dow Chemical plant in Freeport.

First trial tests were somewhat disappointing inasmuch as low current efficiency and short life were experienced. They demonstrated, however, the need for further improvements in technique. Research and experimental installations since then have shown that magnesium offers an efficient and economically sound method for cathodic protection of pipelines and other underground structures. It has been demonstrated that, when properly installed, as much as 500 ampere-hours of electricity are realized from every pound of magnesium consumed at the anode. In fact, under some operating conditions, an electrical output of 600 or more ampere-hours per pound has been realized.

Three Factors Affect Anodes

It has been found that the current efficiency and life of magnesium anodes depend largely upon three factors, the composition of the metal used, the electrolyte used around the anode and the current density at which the anode operates.

On an operating magnesium anode, two types of corrosion are in evidence. The first, or useful corrosion, results from the current provided by the anode for the protection of a remote cathode, such as a pipeline. The second, local, or non-useful corrosion represents current supplied by the magnesium to protect local cathodes in and on the magnesium anode itself. The rate of local corrosion is obviously of great importance since the ratio of useful corrosion to local corrosion determines the operating efficiency of the anode.

TABLE 1—Composition of Magnesium Alloy for Anodes

Content	%
Aluminum	5.3 to 6.7
Manganese (minimum)	0.18
Zinc	2.5 to 3.5
Silicon (maximum)	0.3
Copper (maximum)	0.05
Nickel (maximum)	0.003
Iron (maximum)	0.003
Other impurities (maximum)	0.3
Magnesium	Balance

Laboratory experiments indicated that the rate of local corrosion is a variable which also depends upon the three factors just previously mentioned. Even though commercially pure magnesium has 0.1 volt higher solution potential than alloy, it is much more subject to lower current efficiency. A special alloy has therefore been developed for anodes which realizes a high current efficiency and reduces to a minimum the rate of local corrosion by controlling the copper, nickel, and iron content. This alloy for anodes has the composition given in Table 1. As far as has been determined to date, an alloy having substantially this composition is generally suitable for use in magnesium anodes.

The second factor upon which current efficiency and life of the anodes depends is that of backfill, or the electrolyte used around the anode. Although initial work on backfill indicated that chlorides, well known as good electrolytes, used with an inhibitor such as

TABLE 2—Backfill for High Efficiency and Life of Magnesium Anodes

1. For low resistance soils
   3 parts Bentonite
   1 part ground Gypsum, Hydrated ($CaSO_4H_2O$)
2. For high resistance soils
   2 parts Bentonite
   1 part ground Gypsum, Hydrated ($CaSO_4H_2O$)
   1 part Anhydrous Sodium Sulphate

chromic acid and mixed with the natural soil, would make a suitable environment for the anodes, it was soon discovered that this type of backfill was unsatisfactory because of the high solubility of chlorides and the non-uniformity of soils.

Results of numerous investigations of other types of backfill showed that gypsum-clay mixtures were more desirable than chlorides. Bentonite was later substituted for clay soil in order to secure a more homogeneous environment and one which could be standard for every installation. It has been found that the most efficient backfill, to obtain high anode efficiency and life, is as shown in Table 2.

As regards the effect of current density on anode efficiency, it may be said that when using the alloy, a current density of the order of 0.5 milliamperes/-sq in is sufficient to obtain an efficiency of approximately 50%.

A considerable amount of exeperimental work in cathodic protection of pipelines and other structures has been carried on by Dow Chemical Co. One of the first intsallations was made on some 41 miles of 8-in coated and wrapped line in Texas. This was followed by further experimentation on other lines operated by the gas line department. Several miles of bare pipeline in the vicinity of the company's Midland, Mich., plant have been cathodically protected by magnesium. The maintenance department of the company's pipe shop has adopted the practice of installing magnesium anodes on pipelines wherever and whenever leaks occur. Electrical measurements and leak records indicate that this type of protection is very effective.

Of unusual interest was the protection of the flume which brings sea water into the company's Freeport, Texas, plant. This flume, composed of steel piling driven 14 ft. into the earth, is 2300 ft long. It is of extreme importance that it operate uninterruptedly. At the time that cathodic protection was applied and at the existing rate of corrosion, its life was estimated at five years.

Magnesium anodes were installed to protect the structure from both sea water and soil. The flume has polarized and its life has been extended for an indefinite period.

How Anodes Are Installed

A further advantage of the use of magnesium anodes for cathodic protection is the ease of installation. The exact technique followed varies, of course, with each installation and depends upon such factors as the size of the line, soil resistivity, and whether or not the pipe is coated. Current requirements for bare pipe, for instance, are much greater than for coated pipe, even though the coating may be poorly preserved.

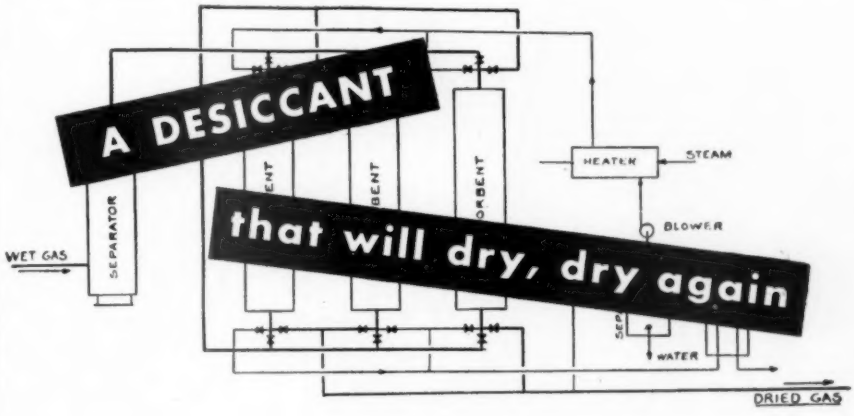
In general, however, the anodes are usually placed about 10 ft. out from the line and are buried in augured holes 6 to 8 ins. in diameter. They are connected to the pipe with suitable copper wire. Experience has shown that best results are usually obtained when the anodes are buried at such a depth that permanently moist soil is encountered.

The spacing of the anodes varies considerably and depends upon such factors as current requirements of the line and the type of soil encountered. Spacing may range from 50 ft. to several miles. The life of anodes in service is dependent upon their size and the rate at which current is supplied. A 17-lb. anode supplying one ampere of current will have a life of about one year, while a 50-lb. anode at the same current flow will have a life of approximately three years. Reduced current output will of course prolong anode life. Thus the 17-lb. anode supplying only one-tenth amprere of current, as is normally the case on pipeline installations, will have an estimated life of about 10 years. A backfill material, the composition of which has already been discussed, surrounds the anode.

Special anodes have been designed by Dow Chemical Co. and are now available in three different sizes. The first type is 4 ins. in diameter, 20 ins. long, and weighs approximately 16 lbs. The second is 60 ins. long with a D cross section shape. It is 4 ins. across the flats and 4 ins. deep. The weight is approximately 55 lbs. The third type is an 8-in. diameter anode, 16 in. long, and weighs approximately 53 lbs. The anodes are all cast with a galvanized steel core and are furnished with 10 ft. of 14-gage single strand direct burial copper wire.

A large and representative group of pipeline, utility and communication companies are now making use of magnesium for cathodic protection of buried structures and also those exposed to sea water. Although in most cases current use is on an experimental or trial basis, preliminary reports and surveys to date indicate that magnesium offers important and far reaching possibilities in the prevention of corrosion.

Because of the widespread interest in the use of magnesium for cathodic protection, Dow Chemical Co. is constructing a large metal protection laboratory. Its equipment will be the most modern and the results of its research work will be generally available. It will cooperate with the research work of other industries along the line of corrosion prevention.



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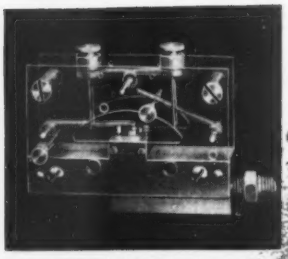

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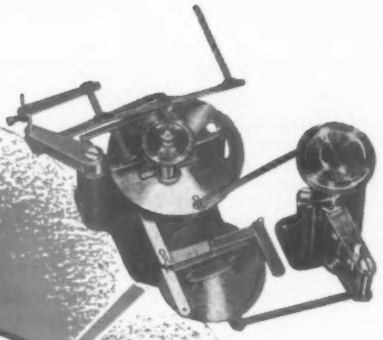

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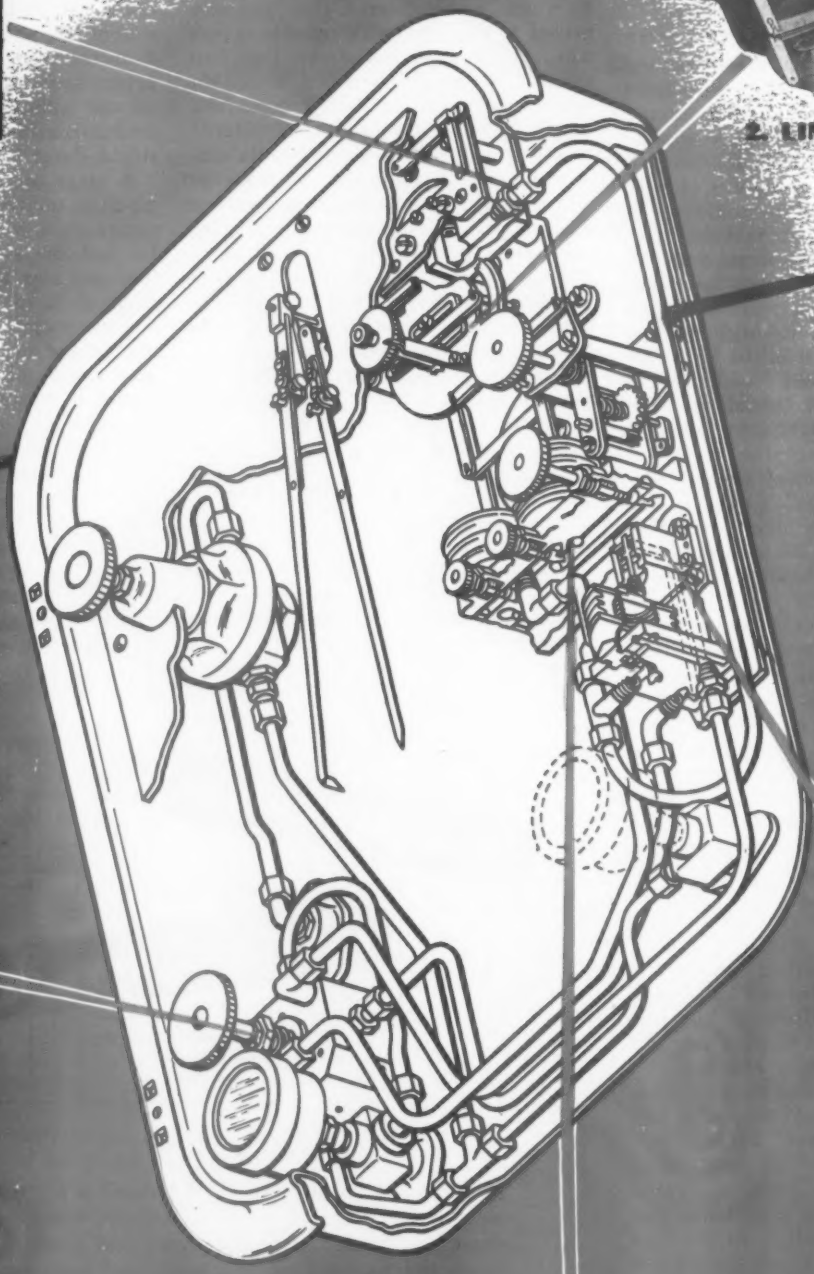

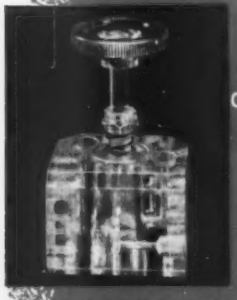

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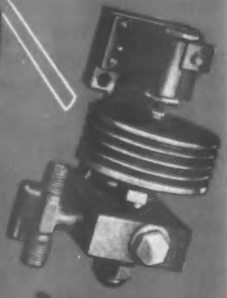

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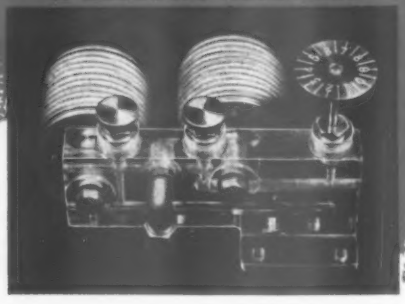
4. BELLOWS ASSEMBLY



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Patent Trends in Petroleum Refining

By Peter J. Gaylor

Editor "The Technical Survey"

Some new patents on such specialty products as binding agents for asphalts, agents for improving waxes, an additive for transformer oils and a rust preventive are reviewed. A new patent for an anti-foaming gear lubricant is disclosed, and a means for reducing the cost of ethyl bromide as a fire extinguishing medium. In the chemicals field the production of dialkyl phthalates is described. An additive for removing aromatic compounds from diesel fuel oil is mentioned.

Specialties

In recent years a new art has been built up around the improvement in the **adhesivity of asphalts** when they are used as bonding agents, particularly for paving aggregates, coating metals, and so on. A patent recently issued to Standard Oil Development Co. (U. S. 2,389,680) discloses the use of amino alkylamides of carboxylic acids as binding agents.

In the use of aminoethyl stearylamide for this purpose, a Venezuelan rapid-curing type cut-back asphalt was applied to a dry aggregate and a wet trap rock containing 2% water. The results, with varying amounts of amide, are given in Table 1.

The term "stripping resistance" is defined as the percentage of the aggregate surface still remaining coated with asphalt after the coated mixture which has been cured for one hour at room temperature has been covered with water maintained at room temperature for a period of 20 hrs. A reaction product of an ester or glyceride and a polyalkylene polyamine, e.g. ethyl oleate and diethylene triamine, may also be used.

Among some other adhesivity improvers, disclosed in the past, are imidazoline[1], lead soap[2], calcium oleate[3], cation active amines[4], condensation products of olein[5], benzene sulfonic acid esters[6], lauryl amine[7], and fatty acid esters[8].

A method of raising the melting point of asphalt is described in the Harvel Research Corp. patent U. S. 2,383,769. In this case, the asphalt is heated with about 1-10% of its weight of a lower dialkyl sulfate (such as diethyl sulfate) at about 200° C., until its melting point is increased at least 17° C.

Methods for improving waxes have also been covered. For example, the Sowa patent U. S. 2,383,521 specifies dewaxing of petroleum, montan, carnauba or beeswax in the presence of a small amount of an organic silicane such as tetraamyl silicane, thereby obtaining an oil-free wax of better color, greater hardness and higher purity.

U. S. 2,391,988, issued to Standard of Indiana, describes the preparation of candles from wax having a core of wax mixed with 1-30% of an aerogel.

In the **insulating oil** field, Union Oil Co. has obtained Can. 431,274 on an improved transformer oil containing less than about 0.5% of di-isoamyl tartrate.

Tidewater Oil's **rust preventive composition** given in its U. S. 2,392,102, has the following formula: Wool fat having its normally contained esters partially saponified with an alkaline earth metal hydroxide, 50-80 pts; wax, 20-50 pts; a solvent for the wool-fat and wax, 500-2000 pts; a surface tension depressant, 0.1-1 pt; and a homogenizer capable of rendering the constituents mutually completely soluble, 0.5-5 pts; the partially saponified wool fat being wax-like and substantially homogeneous at ordinary temperatures.

Lubricants

In the Gulf Oil patent U.S. 2,377,654, a foaming-resisting gear lubrant is disclosed A 5-10% sulfurized sperm oil blend (B) has its foaming tendency reduced considerably by the addition of 0.2-1% of potassium oleate (Blend A). Table 2 shows some results obtained in a Mix-master test with these blends.

Some new **greases** have been disclosed by Cities Service Oil Co. In its U.S. 2,389,924, a low temperature grease is covered, containing 4-20% **sodium soap**, and 96-80% picoline with which the soap is compatible. **Picoline** is claimed to have the following properties:

Vis. at −40°F.	3.06 cs.
Vis. at 0°F.	1.97
Vis. at 100°F.	0.76
Vis. at 200°F.	0.52
Melting point	−94°F.
Boiling point	262°F.
Sp. Gr.	0.95

Another grease disclosed in U.S. 2,391,842 contains **silver stearite.** A composition containing 87.5% mineral lubricating oil, 11% silver stearate and about 1.5% aluminum stearate is said to have a stable plastic gel-like consistency after being heated to 400°F. and then cooled. Some of the greases disclosed pass the Navy low temperature test at −67°F.

TABLE 1—Stripping Resistance Test for Asphalt, Aminoethyl Stearylamide Used as Binding Agent

(From U. S. Patent 2,389,680)

Percent Agent in R.C.T. Cutback	Dry Trap Rock 1 Hr. Cure	Dry Trap Rock 2 Hr. Cure	Wet Trap Rock (2% H_2O) Mixing Ability	Wet Trap Rock (2% H_2O) 1 Hr. Cure	Wet Trap Rock (2% H_2O) 2 Hr. Cure
0.4%	100	100	100	100	100
0.2%	100	100	95	90	95
0.1%	70	80	90	10	30

TABLE 2—Foam Test on Gear Lubricant

(From U. S. Patent 2,377,654)

Gear Lubricant	A*	B*
At end of stirring:		
Volume of oil and foam, cc.	580	1,740
Temperature, °F.	82	84
Temperature rise	5	7
Increase in volume, cc.	80	1,240
Ratio[1]	1.16	3.48
Nature of foam	Fine	Coarse
After 1 hr. standing:		
Volume of oil and foam, cc.	540	660
Temperature, °F.	77	77
Increased volume, cc.	40	160
Ratio[1]	1.08	1.32

*A is oil B with 0.2-1% of potassium oleate added.

*B is a 5-10% sulfurized sperm oil blend.

[1]Ratio of $\frac{\text{volume of oil and foam}}{\text{volume of original oil}}$

Extinguishing Fires

Ethyl bromide has been used to some extent in aviation as a fire extinguisher. However, its cost is high, so that its use for commercial purposes is questionable. Timpson has recently obtained U. S. 2,389,652 which discloses the possibility of reducing the cost somewhat by dilution with cheaper materials, although the compositions are claimed to be better because of a "balanced" vapor pressure, toxicity, and the like.

Good fire extinquishing action can be obtained by the use of a composition having the following constituents:

Ethyl bromide	70-90%
Methyl bromide	5-10%
Ethylene chlorobromide	5-20%

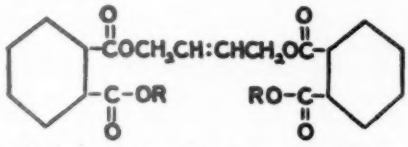
The compositions will not freeze at −100°C. They are lighter in weight and

will not permit flash-back to the combustible material.

Chemicals

The production of 2-butene-1,4-diol **dialkyl phthalates** from 1,4-dichloro-2-butene has been described by Taylor in his U.S. 2,391,849. These compounds are obtained by refluxing a mixture containing absolute methanol, metallic sodium and phthalic anhydride, adding more methanol and then the dichlorobutene. Sodium chloride separates out during the reaction and, after cooling, it is filtered off, the alcohol distilled off, leaving the diester in 68% yield.

The compounds have the structure shown below and proper ties as listed in Table 3.



Shell has been able to produce **chloroprene** by pyrolysis of 2,3-dichlorbutene-1. In one example, this compound was cracked in a quartz tube (with recirculation of condensate) to give the following yields, based on the dichloride consumed:

Vinyl acetylene	0.7%
Chloroprene	56.7
Chloroprene polymer	17.7
Chlorine-free polymer	10.6
Loss	10.9

In the same manner, 1,2-dichlorbutene-2 was pyrolyzed to yield 35.7 mole % chloroprene. It was observed that about 14% of the 1,2-dichlor olefin was allylically rearranged to the 2,3 isomer (U.S. 2,391,827).

Diesel Fuel Oils

Aromatics are generally considered as undesirable components in Diesel fuels. One Socony-Vacuum patent (2,392,570) removes such constituents by adding trioxymethlene (polymeric formaldehyde) and hydrofluoric acid catalyst. After standing overnight at room temperature, the aromatics were found to have reacted with the aldehyde to give a high melting, hard, rather brittle, red-green resin in 42% yield (on the fuel oil).

The fuel oil was found to have a cetane number of 27.0, compared to 23.5 for the base fuel.

References

(1) U.S. 2,361,488 (Standard Oil Dev. Co.)
(2) U.S. 2,243,409 (Standard Oil Dev. Co.)
(3) U.S. 2,192,284 (A. Johnson & Co.)
(4) U.S. 2,191,295 (I.G.)
(5) Zellinger, Rev. Petrol. 3/10/39, p. 344.
(6) U.S. 2,225,570 (Shell)
(7) Brit. Pat. 560,716 (Standard Oil Dev. Co.)
(8) U.S. 2,280,653 (Standard Oil Dev. Co.)

Selected Patents of the Month

U.S. 2,388,160 (duPont) — Separating ethylene polymers.
U.S. 2,388,167 (Shell)—Copolymerization.
U.S. 2,388,322 (Texas)—C_4 recovery.
U.S. 2,388,410 (Shell)—Ketone resins.
U.S. 2,388,477 & 514-5 (Goodrich) — Polymerization modifiers for butadiene.
U.S. 2,391,920 (duPont)—Polymerizing ethylene in presence of dialkyl dioxide.
U.S. 2,391,944 (Std. Oil Dev. Co.) — Hydrocarbon conversion.
U.S. 2,391,962 (Texaco) — Isomerizing cracked naphtha with adsorbent catalysts.
U.S. 2,392,000 (Texas)—Hydrocarbon polymerization with $100SiO_2{:}2Al_2O_3{:}12ZrO_2$.
U.S. 2,392,102 (Tidewater) — Rust preventive.
U.S. 2,392,107 (Sinclair Rfg.) — Co amination catalyst.
U.S. 2,392,158 (Amer. Cyanamid)—Oil soluble dyes.
U.S. 2,392,248 (Kellogg) — Hydrocarbon conversion.
U.S. 2,392,252-3 (Sinclair Rfg.) — P-S condensation product in lubricating composition.
U.S. 2,392,284 (Shell) — Isomerizing butane.
U.S. 2,392,289 (Monsanto)—Styrene.
U.S. 2,392,294-5 (Shell) — Photochemical preparation of thio ethers and halo thio ethers.
U.S. 2,392,750 (Std. Oil Dev. Co.) — Dehydrogenation of hydrocarbons.
U.S. 2,392,773 (Std. Oil Dev. Co.) — Catalytic-thermal cracking.
U.S. 2,392,779 (Std. Oil Dev. Co.) — Detergent in paste form.
U.S. 2,392,791 (Std. Oil Dev. Co.)—Isomerization.
U.S. 2,392,798 (Phillips Petroleum) — Catalytic contacting.
U.S. 2,392,579 (Shell) — Desulfurizing olefinic gasoline by hydrogenation.
U.S. 2,392,585 (Goodrich) — Emulson polymerization of butadiene.
U.S. 2,392,588 (Shell) — Hydrocarbon conversion with silica-alumina-boria catalyst.
U.S. 2,392,610 (Socony) — Halo nitrolic acid diesel dopes.
U.S. 2,392,611 (Socony) — Diesel dopes containing T—N=N—C—NO_2 group.
U.S. 2,392,620 (S.O. Indiana) — Fluorescent marker for petroleum products.
U.S. 2,392,738 (Std. Oil Dev. Co.)—Aromatization.
U.S. 2,392,739-40 (Std. Oil Dev. Co.) — Olefin segregation.
U.S. 2,392,749 (Stand. Catalytic) — Aromatics from petroleum.
U.S. 2,393,288 (Union Oil)—Catalytic reforming.
U.S. 2,393,321 (Jasco)—Cured polymers.
U.S. 2,393,357 (Anglo-Iranian) — Isomerizing n-butane.
U.S. 2,393,381 (Carbide) — Butadiene from alcohol and acetaldehyde.
U.S. 2,393,476 (Phillips Petroleum) — Sweetening gasoline.
U.S. 2,393,510 (Shell) — Unsaturated ketones.
U.S. 2,393,512-3 (Shell) — Polyvinyl chloride or acetal and glycerol di(cresylic acid) ether.
U.S. 2,393,526 (Allied Chemical & Dye)—Alkyl aromatic compounds.
U.S. 2,393,531 (Standard Oil Dev. Co.) — Isoparaffin-olefin alkylation.
U.S. 2,393,532 (Shell) — Catalytic oxidation of ketones.
U.S. 2,393,537 (Union Oil) — Catalytic dehydrogenation.
U.S. 2,393,554 (Standard Oil Dev. Co.) — Catalyst recovery.
U.S. 2,393,573-4 (Shell)—Albino asphalt.
U.S. 2,393,636 (S.O. Indiana) — Hydrocarbon conversion with suspended catalyst.
U.S. 2,393,650 & 74 (Consolidated Engineering Corp.) — Apparatus for analyzing hydrocarbons.
U.S. 2,393,778 (Tennessee Eastman)—Ketene.
U.S. 2,393,797 (Cities Service) — High temperature greases.
U.S. 2,393,798 (Cities Service) — Varnish removers.
U.S. 2,393,800 (Cities Service) — Valve lubricants.
U.S. 2,393,818 (Universal Oil Products) — Alkylating aromatics.
U.S. 2,393,893 (Socony) — Catalytic conversion with finely divided catalyst.
U.S. 2,393,895 (Texas) — Selectively separating propylene and ethylene.
U.S. 2,393,909 (S.O. Indiana) — Chemical reaction with fluidized solids.
U.S. 2,393,925 (Shell)—Heterocyclic insecticide.
U.S. 2,393,934 (Socony) — Phosphated sulfurized oil.

Austral. S.P. 120,231 (Wingfoot) — Hexadiene polymers.
Austral. S.P. 120,525 (Trinidad Leaseholds) — Paraffinic hydrocarbons heat treated to maximum distillate and minimum coke and gas.
Austral. S.P. 120,584 (Corning Glass)—Polymeric silicone having lubricating properties.

Br. 473,670 (duPont) — Vinyl Chloride. Note activity in this field.
Br. 572,133 (Standard Oil Dev. Co.) — Vulcanizable compositions.
Br. 572,264 (Standard Oil Dev. Co.) — Dehydrogenation.
Br. 573,408 (Shell) — Removing oil from water.
Br. 573,456 (duPont) — Vinyl cyanide.
Br. 573,467 (Distillers Co.) — Acetic acid.
Br. 573,475-6 (Imperial Chemical Indus.) — Chlorinated phenoxy compounds.
Br. 573,495 (Distillers Co.) — Acetaldehyde.
Br. 573,477-9 (Imperial Chemical Indus.) — Chlorcresols and derivatives.
Br. 573,484 (Universal Oil Prods.)—Isomerization.
Br. 573,499 (Std. Oil Dev. Co.)—High pressure chemical reactions.
Br. 573,531 (Distillers Co.) — Reducing peracid content of oxidation products.
Br. 573,532 (Distillers Co.) — Demuriation.
Br. 573,561 & 94 (Distillers Co.) — Vinyl chloride.
Br. 573,573 (Distillers Co.) — Unsaturated aldehydes and ketones.
Br. 573,575 (Distillers Co.)—Ethylene oxide
Br. 573,757 (American Cyanamid) — Polymerizing allyl alcohol.
Br. Appl. 7803/45 (Imperial Chemical Industries) — Products of polytetrafluorethylene.
Br. Appl. 6720/45 (Shell) — Fungicide and bactericide.
Br. Appl. 4016/43 (Standard Oil Dev. Co.) — Catalytic conversion.

Can. 432,447 (Shell)—Glycerol recovery.
Can. 432,448 (Shell)—Olefin oxide.
Can. 432,450 (Shell)—Epoxide recovery.
Can. 432,451 (Shell) — Unsaturated alcohol chlorination.
Can. 432,453 (Standard Oil Dev. Co.)—Alkylation with ethylene.
Can. 432,454 (Standard Oil Dev. Co.)—Alkylation with propylene.
Can. 430,762-3 (Anglo-Iranian)—Isoparaffins.
Can. 430,837 (S.O. Indiana)—Cracking catalyst.

TABLE 3—Properties of Dialkyl Phthalates
(From U. S. Patent 2,391,849)

Compound	Physical State
2-butene-1,4-diol dimethyl diphthalate	White solid M. P. 82° C.
2-butene-1,4-diol diethyl diphthalate	White solid M. P. 67° C.
2-butene-1,4-diol diisopropyl diphthalate	Oil-decomposition began at 165° C. (5 mm.)
2-butene-1,4-diol dibutyl diphthalate	Oil-stable to 250° C. (5 mm.)
2-butene-1,4-diol di-2-ethyl hexyl diphthalate	Oil-stable to 250° C. (5 mm.)

Stop Tube Failure in Superheater By Adding Corrosion Inhibitors

Cracking naphtha at temperatures above 1300° F is tough on the tubes of a superheater furnace . . .but failure of 18-8 type stainless steel tubes from acute corrosion after only 120 hours of operation called for action—quickly.

So thought PAW when it requested investigation of premature tube failure in a wartime operation in which naphtha from Refugio, Texas Gulf, crude was being cracked for production of butadiene. Laboratory studies pointed to the absence of certain sulphur compounds in the feed as a possible cause of the trouble. Plant operation confirmed this. Excessive tube corrosion was eliminated by adding 0.05% to 0.5% by weight of sulphur to the naphtha feed stock. Interestingly, the experimental work further indicated that, in this case, excessive corrosion could also be eliminated by simply adding water—within slightly narrower limits—to the feed stock. Why this worked was not determined by the experiments.

Detailed results of the investigation are described in a report—"Corrosion of 18-8 Alloy Furnace Tubes in High-Temperature Vapor Phase Cracking"—the main part of which is published here.

By E. Q. Camp and Cecil Phillips
Technical and Research Division, Humble Oil and Refining Co.

and Lewis Gross
Process Division, Taylor Refining Co.

THIS paper presents a discussion of a unique case of severe hydrocarbon-side corrosion of 18-8 alloy furnace tubes in which failures were experienced after only 120 hrs. of operation. This corrosion occurred in a superheater furnace in which a 200° to 400° F. boiling range naphtha was cracked in vapor phase for the production of butadiene.

Operating Data

The true vapor phase process is employed in reforming 200° to 400° F. boiling range naphtha at a temperature of 1310° to 1325° F. for the production of butadiene. This process was adapted for this purpose as a part of the governmental program that was put into effect to meet the demand for the production of butadiene required in making synthetic rubber. Three plants of this type were constructed by Defense Plant Corp. for operation under contract with Rubber Reserve Co.

One of these plants is operated by Taylor Refining Co., Corpus Christi, Texas. In the initial operation of this plant, a peculiar and acute type of corrosion was experienced which resulted in the failure of the type 304, 18-8 alloy tubes in the naphtha circuit of the superheater furnaces after only 120 hrs. of operation. Similar corrosion was experienced at the other two plants.

One of these plants is in operation at present, and the other was converted into a unit for the production of gasoline after several months of intermittent operation during which attempts to develop methods of suppressing the corrosion were unsuccessful. It is believed that the type and degree of corrosion experienced at these plants are without parallel.

Plant Operation

A flow diagram of the true vapor phase process as it is employed in the production of butadiene is shown in Fig. 1.

The fresh feed to the plant operated by Taylor Refining Co. amounts to approximately 2000 b/d with both superheaters in operation. Most of the fresh feed is pumped directly into the furnace feed accumulator. Approximately 400 b/d enters the top of the absorber in which it flows countercurrently to the effluent by-product gas. This naphtha is withdrawn as a side stream and flows into the furnace feed accumulator.

In addition to the fresh feed, the furnace charge contains approximately 400 b/d of aromatic distillate (from side stream stripper on fractionator) and about 750 b/d of debutanizer bottoms.

The combined feed is charged to a preheater that is operated with an outlet temperature of approximately 950° F. The charge is then heated in two superheaters (operated in parallel) to a temperature of approximately 1325° F. which

This report was originally published in the September 1945 issue of "Corrosion" official publication of the National Association of Corrosion Engineers.

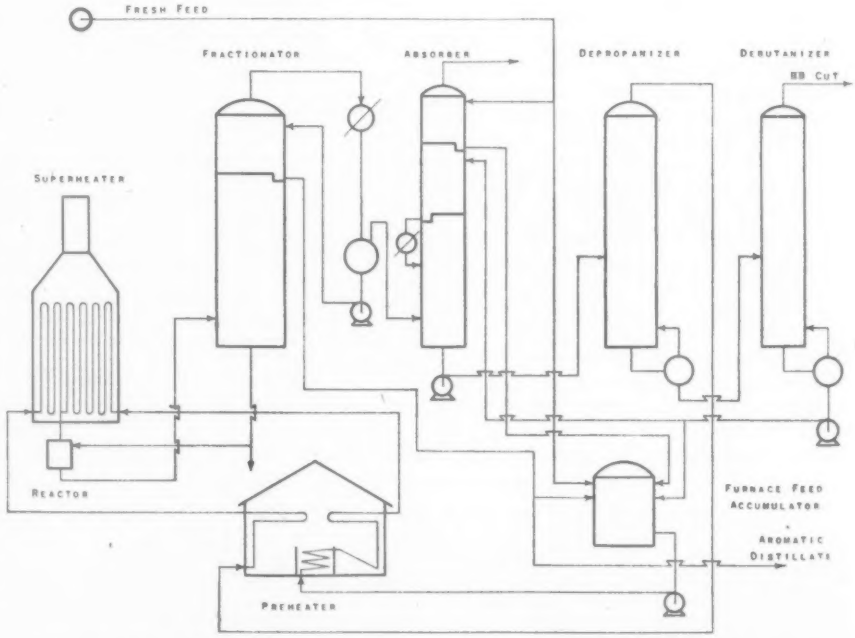


Fig. 1—Flow diagram of butadiene plant operated by Taylor Refining Co.

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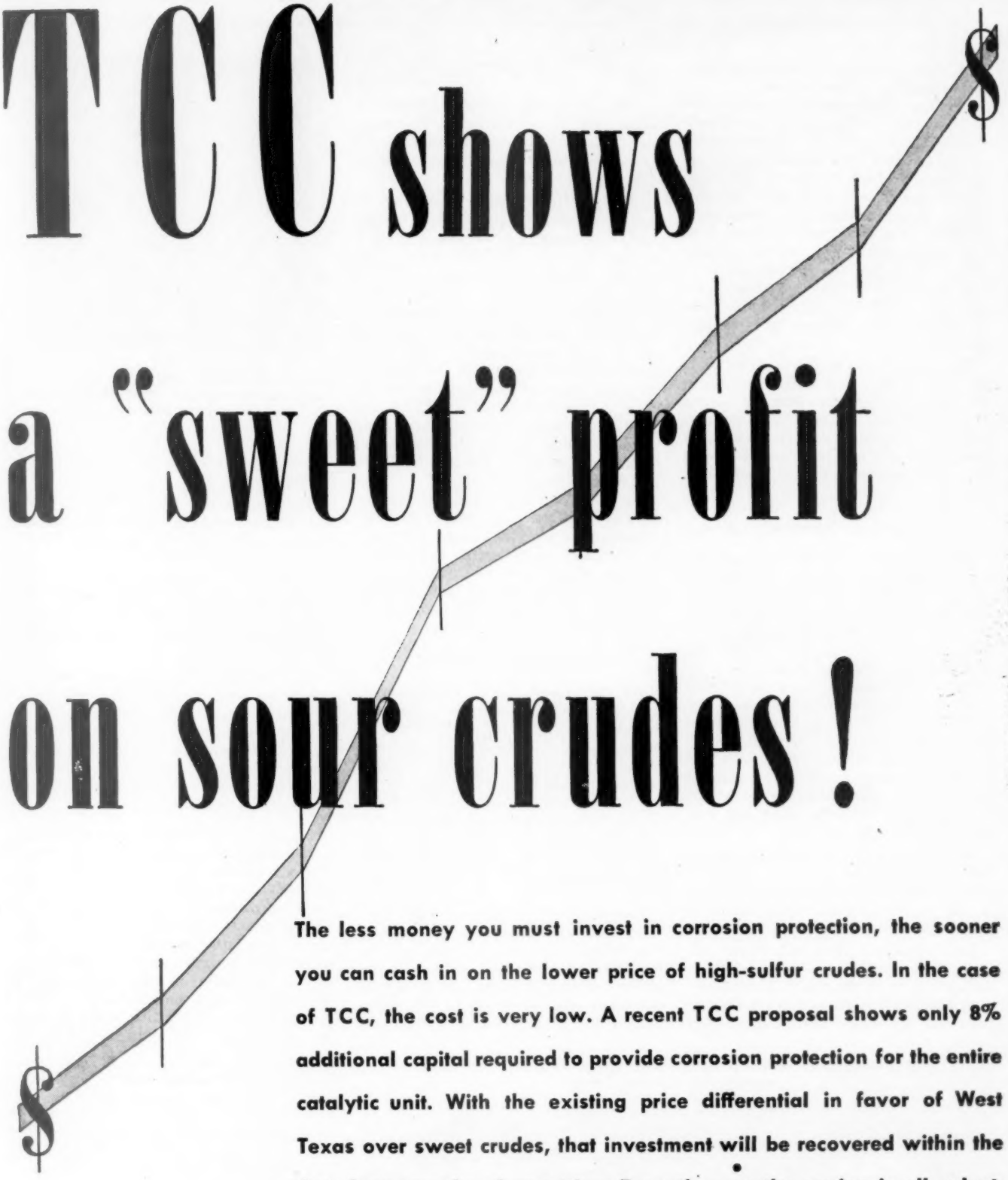

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is slightly below the optimum temperature required for the reaction.

The vaporized naphtha is mixed with a recycle gas (depropanizer overhead) that has been heated in separate sections of the furnaces to a temperature of approximately 1440° F. The resulting mixture is passed into a reaction chamber and is then quenched to a temperature of 400° to 450° F. with bottoms from the fractionator. The reactor product stream flows into the fractionator.

From this point the operation of the equipment (fractionator, absorber, depropanizer, and debutanizer) is conventional.

The recycle gas is the overhead from the depropanizer and amounts to about 150,000 cu. ft. per hour. This gas consists of approximately 65 mole-% of propane and and propylene and 25 mole-% of ethane and ethylene, the remainder being hydrogen, methane, butane, and butylenes.

Furnace Operation

The combined naphtha feed and the recycle gas are charged in separate circuits to a single preheater furnace. The naphtha and recycle gas leave the preheater at temperatures of approximately 950° F. and 700° F., respectively, and flow separately through each of two superheater furnaces operated in parallel.

Each superheater furnace contains 108 vertical tubes, 27 ft. in length with an outside diameter 2⅜ in. and a wall thickness of 0.156 in. The naphtha and recycle gas circuits contain nine parallel passes each. Each naphtha pass and each gas pass contains eight and four tubes, respectively.

All the tubes are of type 304 stainless steel (18% chromium, 8% nickel), except for the first two tubes in each pass of the naphtha circuit which are of 4 to 6% chromium steel.

Each furnace is fired with twelve 18-in. burners arranged in a circle (approximately 8.75 ft. in diameter). The burners are set at a 30° angle with the horizontal floor and are sloped toward the burner circle to give the flame a whirling motion.

The air to the burners is heated to about 600° F. in convection heaters on top of the superheaters. In addition, the burner aspirators draw in approximately 10% of cold air.

The naphtha and recycle gas from the preheater enter the superheaters through separate distributing rings at a pressure of approximately 110 psi. Each stream is admitted to the superheater furnace tubes through critical velocity orifices (approximately 0.5 in. in diameter).

The inlet pressure for each superheater pass is approximately 30 to 40 psi with an outlet pressure of about 20 psi. The outlet temperature of the naphtha and recycle gas are approximately 1325° F. and 1440° F., respectively. The vapor velocity through the naphtha tubes varies from 80 ft. per sec. at the inlet to 320 ft. per sec. at the outlet.

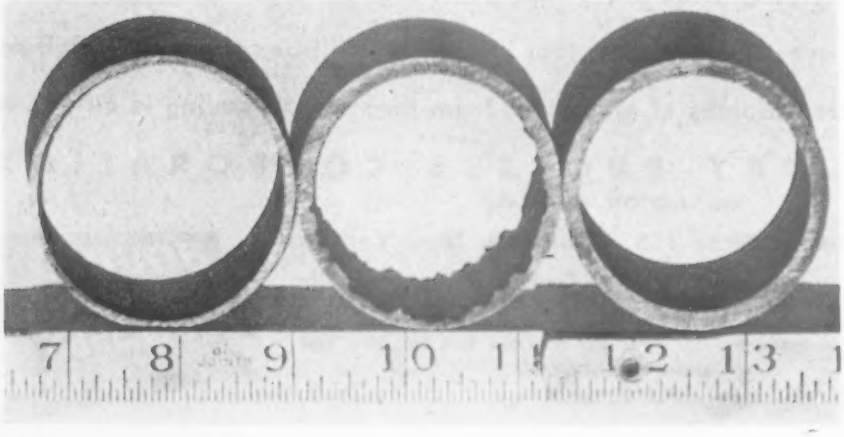
The two streams are combined at the outlets from the superheaters and are mixed in the reactors (capacity of each is 3.6 cu. ft.). The product streams from the reactors are quenched to a temperature of 400° to 450° F. with bottoms from the fractionator, and then are allowed to flow into the fractionator.

Corrosion of Tubes

In the initial stages of processing naphtha from Refugio crude at the plant operated by Taylor Refining Co. for the production of butadiene, the plant was rendered inoperable because of rapid corrosion of the 18-8 alloy tubes in the naphtha circuit of the superheater furnaces. This corrosion resulted in the failure of the tubes (particularly those near the outlet, i.e., the seventh and eighth passes) in from 120 to 400 hours of operation.

Examination of a number of tubes from the superheater furnaces indicated that the failures were due primarily to uniform thinning of the tube walls; however, severe pitting did occur, particularly in the tubes near the inlets to the superheaters and in new tubes in the outlet passes when they were first put into operation.

Fig. 2—Examples of uniformly thinned, pitted, and new 18-8 alloy superheater furnace tubes



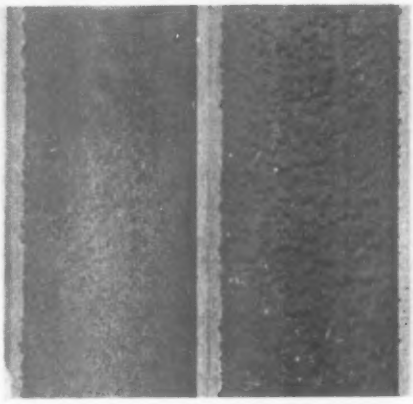


Fig. 3—Internal surface of 18-8 alloy superheater furnace tube showing severe pitting on side facing fire

Fig. 2 shows examples of both the general thinning and the pitting type of corrosion experienced, and a section of a new tube. Fig. 3 shows a section cut longitudinally through one of the tubes which had undergone severe pitting. It will be observed that one side is severely pitted while the other is only slightly attacked.

The corrosion was limited primarily to the center sections of the tubes and was more severe on the side (internal surface) next to the burners. The end sections (4 to 6 ft.) and the return bends were relatively free of corrosion. This indicates that metal temperature is an important factor in the corrosion.

The results of a number of metallurgical examinations of sections of tubes from Taylor's butadiene plant and, for comparison, from Lion's plant in which no severe corrosion was experienced initially, showed that the furnace tubes from both plants were rather severely carburized. It is generally known that carburized 18-8 alloy is susceptible to corrosion, particularly intergranular and perhaps uniform surface attack, even under mildly corrosive conditions.

The furnace tubes that were examined from these two plants were of identical metal (type 304 stainless steel), were carburized to about the same extent, and were operated under comparable conditions with respect to temperature, pressure, rate of firing, etc. Since severe corrosion was experienced at Taylor's plant in comparison with that experienced originally at Lion's plant, it was thought that the tube failures at Taylor's plant were due to the presence of corrosive constituents in the naphtha charged to the plant.

Analysis of Naphtha Samples

Early in the investigation of this corrosion problem extensive analytical data were obtained on comparable sets of naphtha samples from Taylor's plant and

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from Lion's plant. The results obtained are presented in Table 1.

These data are not conclusive as to the cause of the corrosion experienced at Taylor's plant. In the initial stages of this investigation it was believed that the presence of organic acids in water from the absorber at Taylor's plant was a significant factor in the corrosion of the furnace tubes. The absence of organic acids in a comparable sample from Lion's plant supported this conclusion.

It was postulated that dissolved oxygen in the fresh feed resulted in the formation of organic acids in the cracking step and that these acids were the cause of the corrosion of the furnace tubes.

However, a later plant run in which the fresh feed was maintained free of dissolved oxygen by gas blanketing the naphtha immediately after distillation disproved this assumption, since no apparent decrease in the corrosiveness of the naphtha was observed.

Laboratory corrosion tests not only substantiated the plant run on gas-blanketed Refugio naphtha but also showed that the presence of organic acids in the naphtha inhibited rather than accelerated the corrosion.

A comparison of the data in the table indicates that probably the most significant difference in the charge stocks to the two plants is that the fresh feed and combined feed to Lion's plant contain mercaptan sulfur, whereas comparable streams to Taylor's plant are free of mercaptan sulfur.

Hydrogen sulfide evolution tests at 1300° F. on the combined feed to Taylor's plant and Lion's plant gave 1.3 and 8.7 lbs. of hydrogen sulfide per 1000 barrels of oil, respectively. Similar tests on the fresh feed to these two plants gave 2.1 and 14.1 lbs. of hydrogen sulfide per 1000 barrels of oil, respectively.

These data do not show the cause of the corrosion experienced at Taylor's plant, but they indicate that corrosion at this plant may occur because of the absence of certain sulfur compounds, such as mercaptans, in the combined feed. The basis for this conclusion is, as will be shown later in this paper, that sulfur (as mercaptans, carbon disulfide, free sulfur, etc.) is an excellent inhibitor for the type of corrosion experienced at Taylor's plant as well as for that experienced in other plants employing this process.

Laboratory Studies

Since it was not possible to determine the cause of the corrosion experienced at Taylor's butadiene plant by analyzing the charge stocks and recycle streams, bench scale laboratory studies were conducted (under conditions approximating those existing in the plant) for the purpose of developing the most feasible method of minimizing the corrosion.

The equipment employed in the laboratory investigation is shown in Fig. 4. The various naphthas were cracked in a quartz tube (0.875 in. I.D.) at essentially atmospheric pressure and at temperatures comparable to those employed in plant practice. A naphtha charge rate of 200 cc. per hour was used in these tests. Temperatures were measured with a thermocouple placed against the outside of the quartz tube in the center of the end section of the furnace.

Three 18-8 alloy test specimens (cut from a furnace tube from Taylor's butadiene plant) were placed end-to-end in the quartz tube at the center of the outlet section of the furnace. The location of the metal test specimens is shown in Fig. 4.

The test periods varied in length, but most of the runs were in progress for 20 hrs. The corrosion rates were calculated by the conventional weight-loss method.

The results obtained in tests that were made for the purpose of reproducing the corrosion experienced at Taylor's plant

TABLE 1—Comparison of Analytical Data

	LION OIL REFINING CO					TAYLOR REFINING COMPANY*						
Tests	Fresh Feed	Aromatic Distillate	Debutanizer Bottoms	Flash Drum O.H.	Flash Drum Btms.	Fresh Feed	Aromatic Distillate	Debutanizer Bottoms	Combined Feed	Flash Drums Bottoms	Water From Absorber Bottoms	Water From Absorber Side Cooler
Gravity, °API	61.6	40.8	51.4	55.4	19.6	49.4	37.2	47.0	43.6	.....	.....	.....
I. B. P. °F.	122	179	128	119	170	242	215	113	129	.....	.....	.....
F. B. P., °F.	393	355	367	411	.....	392	360	396	385	.....	.....	.....
Recovery, per cent	98.0	98.0	98.0	98.0	.....	98.0	98.0	95.0	96.0	.....	.....	.....
Residue, per cent	0.7	1.0	1.0	1.0	.....	1.0	1.0	1.0	1.0	.....	.....	.....
Loss, per cent	1.3	1.0	1.0	1.0	.....	1.0	1.0	4.0	3.0	.....	.....	.....
5 per cent off at °F.	154	209	138	144	.....	279	240	143	179	.....	.....	.....
50 per cent	247	247	176	220	.....	321	280	221	291	.....	.....	.....
95 per cent	362	327	343	364	.....	367	336	394	385	.....	.....	.....
Doctor Test	DNPED	Pass	DNP	DNPED	.....	Pass	Pass	Pass	Pass	.....	.....	.....
Copper Strip Corrosion	DNP	Pass	Pass	Pass	.....	Pass	Pass	Pass	Pass	.....	.....	.....
Copper Dish Gum	5.7	80.2	107.3	34.6	.....	2.7	102	154	121	.....	.....	.....
Neutralization Value	0.017	0.021	0.021	0.014	0.063	0.024	0.024	0.028	0.021	0.028-0.042	.....	.....
Lamp Sulfur	0.018	0.018	0.024	0.019	.....	0.014-0.010	0.021-0.019	0.012-0.015	0.025-0.026	.....	.....	.....
Mercury Number	3.5-3	2.5	0.0	0.0	.....	3.5-3.0	3.0-2.0	3.5-4.0	2.0-1.0	.....	.....	.....
Copper Number	3-4	0.0	2.0	1.5	.....	0.0	0.0	0.0	0.0	.....	.....	.....
Ester Number	2.6	5.1	1.9	2.0	.....	2.1	3.6	2.0	3.5	.....	.....	.....
Peroxide Number	0.1-0	1.8	0.3	0.3	.....	1.5-2.7	3.6	2.9	5.5	.....	.....	.....
Hydrogen Sulfide, Qual.	None	None	None	Trace	None	None	None	None	None	.....	.....	.....
Salt Content, Lb./1,000 bbl.	None	None	None	Trace	12.8	None	None	None	None	2.5	.....	.....
Dissolved O_2, Mg./Liter	24.4‡	.....	.....	.....	.....	55	.....	.....	.....	.....	.....	.....
H_2S Evolved at 1300° F., Lb./M. bbl.	14.1	.....	.....	8.7	.....	2.1	.....	.....	1.3	.....	.....	.....
Chlorides, p.p.m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.7	21.3
Sulfates, p.p.m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25	15
Sulfites, p.p.m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	None	None
Sulfides, p.p.m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	None	None
Organic Acids (as Acetic), p.p.m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,580†	340
Iron, p.p.m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	959	37
Total Sulfur, p.p.m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.4	5.4

* Charging Refugio naphtha. This naphtha has stood in tankage for several months.
† No organic acids were found in comparable streams from Lion's butadiene plant.
‡ Fresh feed to naphtha preheater.

are shown in Fig. 5. These results indicate that naphtha from Refugio crude is extremely corrosive to 18-8 alloy under the conditions of the laboratory tests; however, the corrosion rates obtained in the laboratory are not as high as those experienced in the plant.

This difference is probably a function of the velocities employed. The velocity of the naphtha vapors in the laboratory tests was extremely low, whereas high velocities (approximately 200 ft. per sec.) were employed in plant operation.

Maximum corrosion rates occurred at 1400° to 1450° F. Less corrosion was obtained at higher and lower temperatures. It is not known whether there is a reduction in the tendency for the naphtha to corrode at the higher temperatures or whether the deposition of coke at these temperatures is such that the metals are shielded from corrosion.

A series of laboratory tests was made to determine the effect of various sulfur compounds on the tendency of Refugio naphtha to corrode 18-8 alloy in the temperature range of 1300° to 1500° F. The results of the tests in which free sulfur was added to the naphtha are shown in Fig. 6.

Results obtained using similar concentrations of sulfur as butyl mercaptan and carbon disulfide were comparable to those obtained with free-sulfur.

The addition of 0.05 to 0.5% by weight of sulfur (as free sulfur, butyl mercaptan, or carbon disulfide) to the naphtha essentially eliminates its tendency to corrode 18-8 alloy.

It is indicated that lower amounts of sulfur effect marked reductions in the corrosion, but more uniformly consistent results were obtained on adding 0.05% by weight and higher of sulfur.

It was observed also that the addition of sulfur essentially eliminated coke deposition on the 18-8 alloy. Both of these observations have been confirmed by the results obtained in plant operation.

The effect of the addition of small amounts of distilled water on the tendency of the naphtha to corrode 18-8 alloy under cracking conditions is shown in Fig. 7. These data indicate that the corrosion can be eliminated by adding 0.06 to 0.4% by weight of water to the naphtha. Larger amounts of water are not detrimental, but are unnecessary.

It was observed that the addition of water also effected a marked reduction in the tendency of the naphtha to coke 18-8 alloy under the test conditions employed. No plant experience is available to substantiate these results.

Further tests in the equipment previously described indicated that carbon

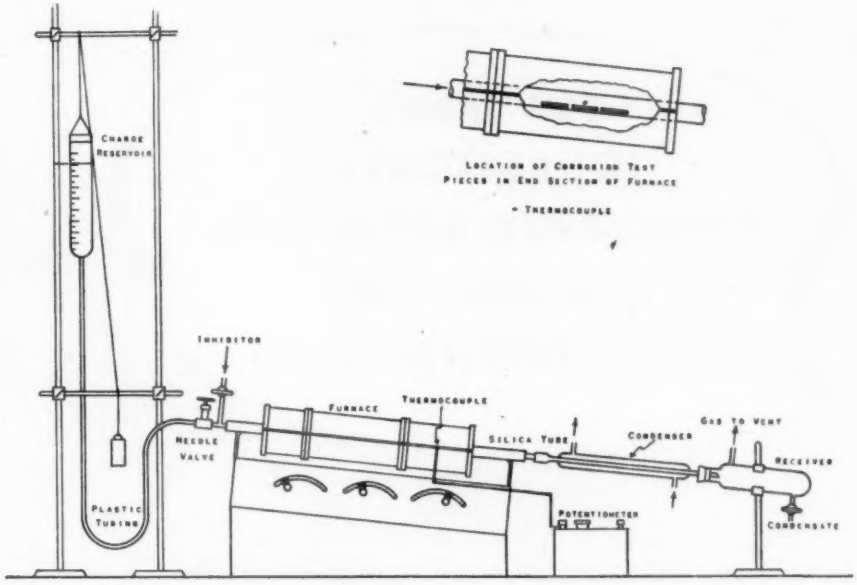

Fig. 4—Apparatus used in corrosion tests

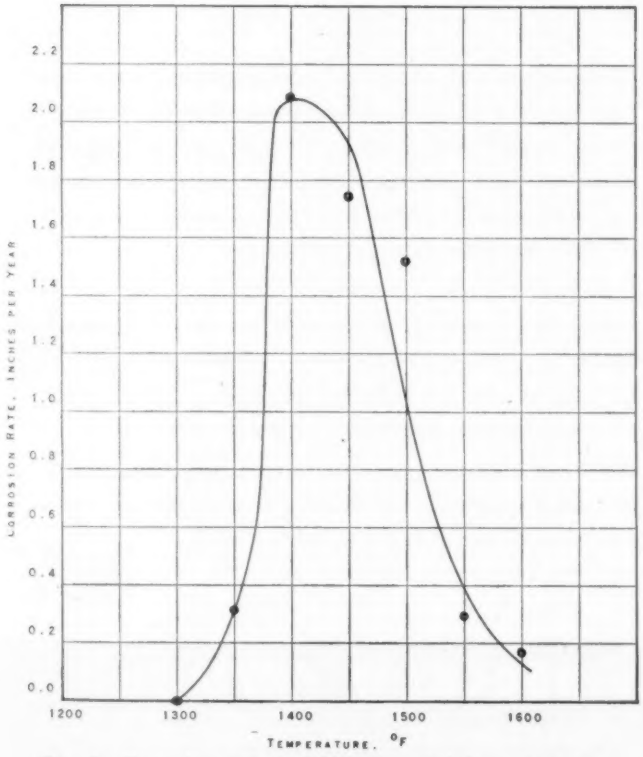

Fig. 5—Corrosion rates of 304-type stainless steel by Refugio naphtha

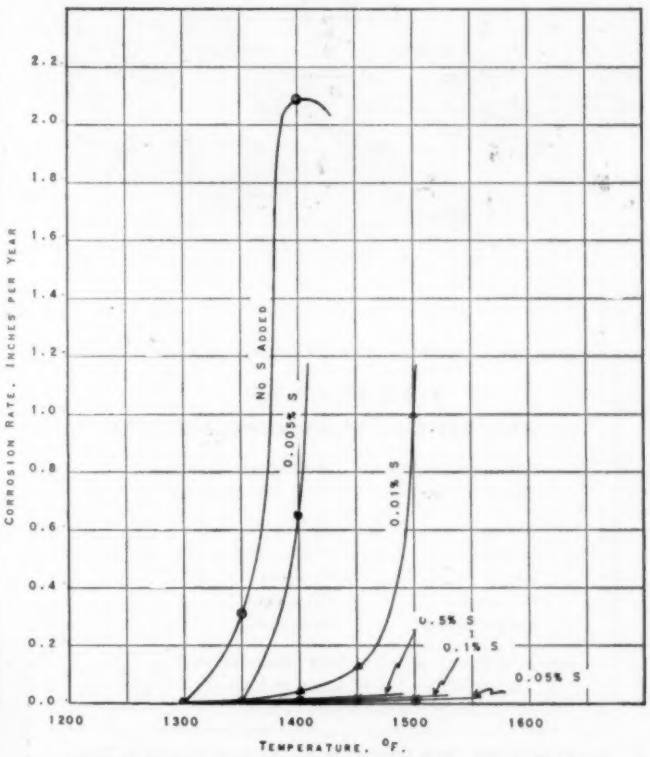

Fig. 6—Effect of sulfur on corrosion of 304-type stainless steel by Refugio naphtha

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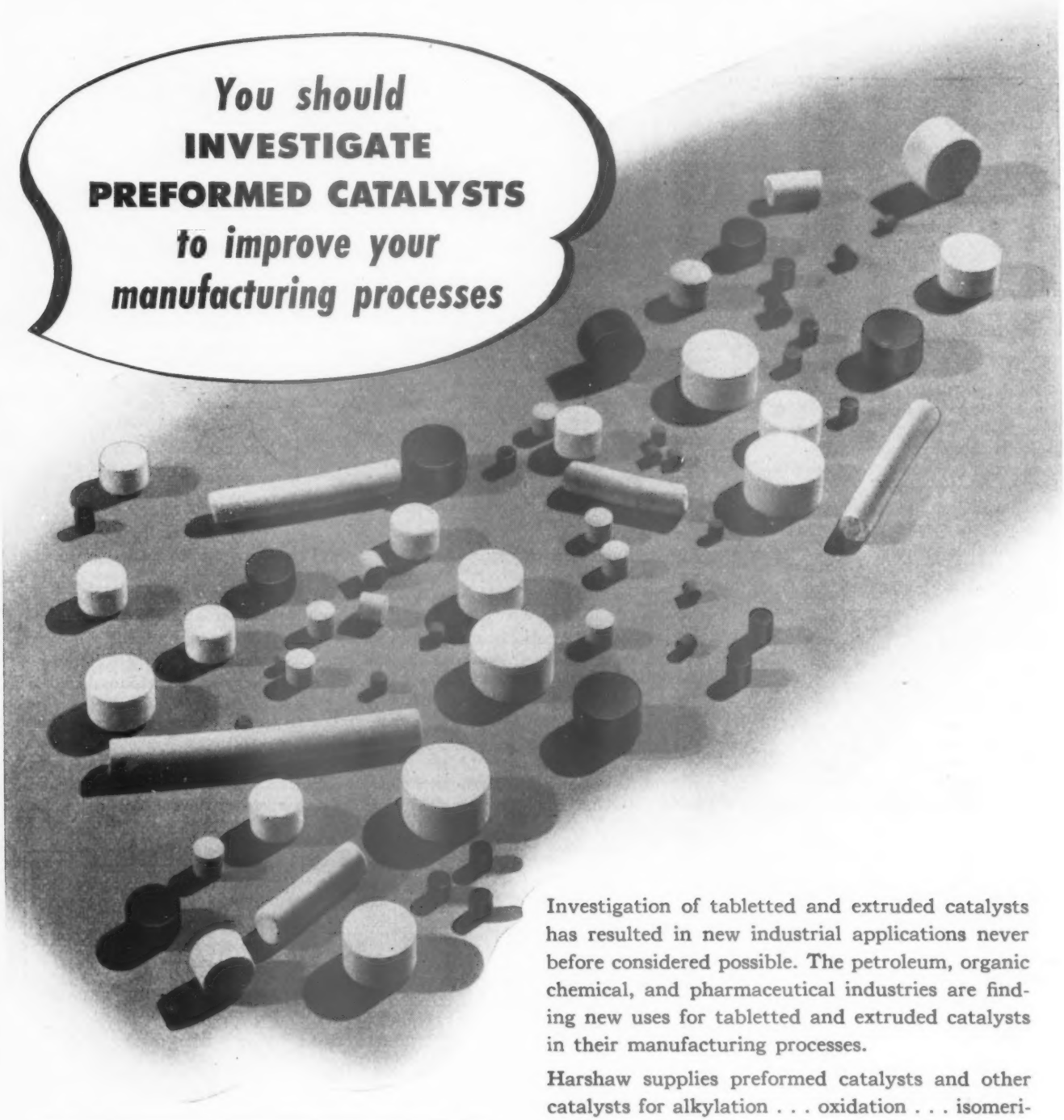

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dioxide, ethyl alcohol, acetic acid, hydrogen sulfide, and sulfur dioxide are satisfactory inhibitors for controlling the type of corrosion experienced at Taylor's butadiene plant.

The optimum quantities of these materials required to maintain corrosion and coke deposition at a minimum were not established because sulfur and water had been found to be adequate for this purpose.

Several exploratory corrosion tests were made in attempts to establish the cause of the corrosion; however none of these tests gave an indication as to the causative agent. It was shown that the removal of active sulfur compounds, peroxides, chlorides, and inorganic salts (by refluxing with molten metallic sodium followed by washing with distilled water and filtering) effected no reductioin in the tendency of the naphtha to corrode 18-8 alloy.

The addition of such compounds as benzoyl peroxide, magnesium chloride, acetylene, isobutylene, normal butane, butadiene, furfural, aniline, etc., to a noncorrosive naphtha (normal hexane) failed to induce corrosion under the cracking conditions employed.

Various types of essentially pure hydrocarbons, such as paraffins, aromatics, naphthenes, and unsaturates, were found to be noncorrosive.

The results of corrosion tests in which oxygen was excluded from the naphtha from Refugio crude indicate that dissolved oxygen is not a significant factor in the corrosion experienced at Taylor's butadiene plant.

Plant Runs

In order to evaluate the possible effect of charge stock on the corrosion of the 18-8 alloy furnace tubes, a trial run was made at Taylor's butadiene plant employing a highly paraffinic naphtha (normal hexane) as fresh feed. This run was in progress for approximately 700 hrs. without any evidence of corrosion of the superheater furnace tubes. Samples of various naphtha streams were taken for analytical examination during this run.

The results obtained on analyzing these samples were not materially different from those obtained on comparable samples when processing Refugio naphtha and are not conclusive as to the cause of the corrosion when processing Refugio naphtha, or to the lack of corrosion when charging normal hexane.

When the trial run on normal hexane was terminated, a run was made on freshly distilled, gas-blanketed Refugio naphtha to which sufficient butyl mercaptan was added to maintain 0.005 to 0.006% by weight of sulfur (as butyl mercaptan) in the furnace charge. This run was terminated after 118 hrs. because of the failure of the eighth tube in a naphtha pass.

The results obtained on inspecting the furnace tubes were not as discouraging as the short length of the run indicated. The seventh and eighth tubes were severely attacked, whereas only incipient corrosion had occurred on the sixth tube.

In previous runs that were terminated in about the same length of time because of tube failures, it was found that the fifth, sixth, seventh, and eighth tubes were corroded to about the same extent with only 0.01 to 0.02 in. of the original 0.156 in. wall thickness remaining.

Because of the results obtained in the first run employing sulfur as an inhibitor and because the laboratory results indicated that sulfur in concentrations up to 0.5% by weight was beneficial rather than harmful to the 18-8 alloy, a second run was made employing a minimum of 0.05% of added sulfur based on the furnace charge. An inspection of the furnace tubes after 135 hrs. of operation showed that no corrosion had occurred in any of the tubes.

As a result of this successful run, operation of the unit was continued. Carbon disulfide is being injected in a quantity sufficient to maintain approximately 0.3% by weight of sulfur (as carbon disulfide) in the furnace feed. The unit now has been in operation for 6,000 hours without any evidence of corrosion in the naphtha tubes of the superheater furnaces.

After 2,764 hrs. of operation with sulfur injection, a failure occurred in one of the outlet tubes of the recycle gas circuit. On inspection, the failure was found to be due to pitting at random in the gas tube. Only one other outlet gas tube was found to be pitted sufficiently to require replacement.

For several weeks prior to the failure of the gas tube, the concentration of hydrogen sulfide in the recycle gas stream was subject to considerable variation. A large quantity of absorber overhead gas had been used for recycle gas which resulted in a substantially lower concentration of hydrogen sulfide in the recycle gas stream. It is thought that this lower hydrogen sulfide content was a contributing factor in the corrosion of the gas tubes.

The addition of sulfur to the furnace feed has essentially eliminated coke deposition in the furnace tubes. With added sulfur in the charge, only a very thin, hard scale formed on the inside of the tubes. Analysis of this scale showed it to be essentially carbon.

Acknowledgments

Extensive work was carried out for the purpose of defining the corrosion experienced at Taylor's butadiene plant, but the cause of the corrosion is not apparent from any of the results that were obtained. The available data do indicate, however, that the corrosion is not due to the presence of chlorides, salts, sulfur, dissolved oxygen, oxygen bearing compounds, or to any one specific type of hydrocarbon (such as paraffins, naphthenes, aromatics, or unsaturates) in the naphtha feed.

The investigation of this problem was conducted at the request of Petroleum Administration for War. The program in general was under the direction of the Technical Advisory Committee with Dr. H. D. Wilde, manager of the Refining Technical and Research division, Humble Oil & Refining Co., as co-ordinator.

The investigation was conducted in Humble's Baytown laboratories, with the assistance of D. C. Walsh and P. S. Viles. The authors wish to acknowledge the helpful suggestions and advice of Dr. B. F. Armendt and Dr. Sherman S. Shaffer of Humble, of J. L. Sewell of Taylor Refining Co., and of Lt. Col. M. C. Rogers and Major R. W. Pachaly of PAW. Appreciation is extended to J. B. Rogerson of Lion Oil Refining Co. for supplying samples and data.

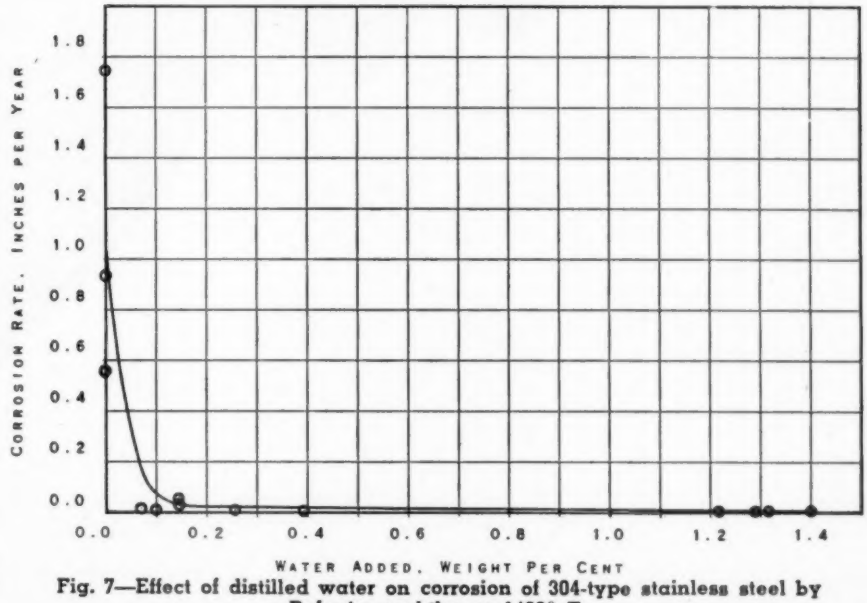
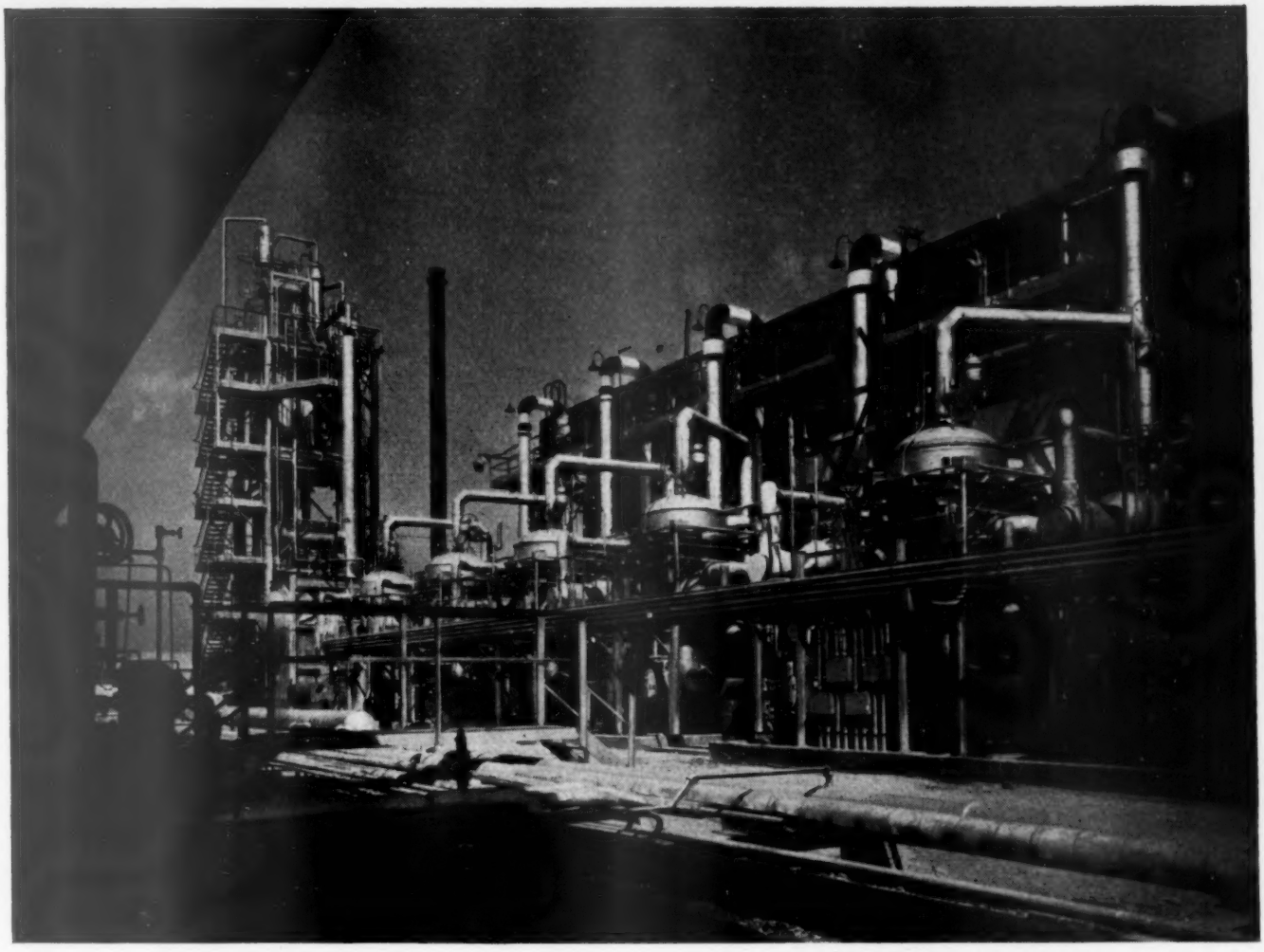


Fig. 7—Effect of distilled water on corrosion of 304-type stainless steel by Refugio naphtha at 1450° F.

SOMEBODY had to know



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Increase Capacity of Absorption Plant By Propane Refrigeration of Lean Oil

By R. W. Heath, J. B. Taylor, Jr., and P. W. Hill
Signal Oil & Gas Co., Los Angeles

What more eggs from the same hen mean to the farmer, more capacity from the same plant is to the natural gasoline operator.

Here are discussed in detail the methods for using propane refrigeration to increase natural gasoline absorption plant capacity through subcooling the lean absorber oil. And the principle has other advantages too:—more selective absorption; generally lower installation and maintenance costs than for other means for increasing capacity; availability of suitable propane within the plant in most cases and its later availability for other plant uses.

Though the authors, writing from practical experience in two recent installations, limit their remarks to low pressure plants, it is probable that many readers will consider the application of this principle to other types of absorption plants; including refinery gas absorption plants which are too burdened by the present scale of the refinery's operations.

The accompanying article and that immediately following include the main portion of a paper by the same authors entitled "Practical Refrigeration for Natural Gasoline Plants," which was presented before the California Natural Gasoline Assn., Jan. 3, 1946, at Los Angeles.

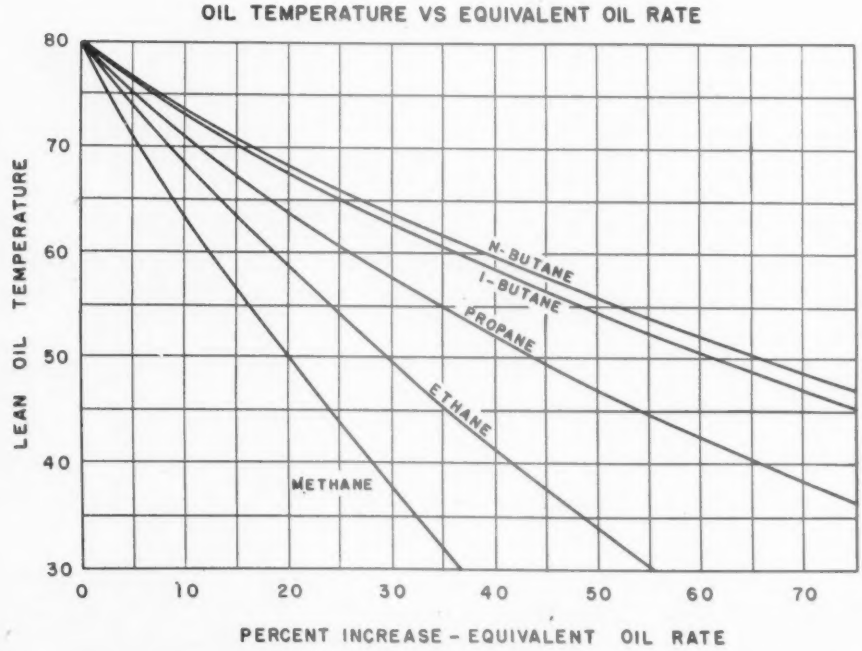

Fig. 1—Data developed at 55 lbs. abs. and for an 80F. base.. Spread in effective vapor pressures can be shown as reciprocals of these values

INTEREST is developing in the use of propane refrigerating units in low pressure natural gasoline absorption plants, with absorber pressures of less than 100 psi. Propane has the advantage of being inexpensive, readily available and of high refrigerating efficiency. Operating pressures are above a vacuum which precludes air contamination and all pressures allow reasonable pipe line sizes without serious pressure drops.

The advantages of refrigeration are not alone due to the reduction in vapor pressures but also the fact that the heavier fractions are reduced to a relatively greater extent than are the lighter hydrocarbons below the butanes. As a result there is a greater spread of vapor pressures between the various hydrocarbons at the lower temperatures. This results in better separation of the fixed gases from the fat oil tank and wherever colder temperatures are developed. As an example of this condition Fig. 1 shows oil temperatures against increased absorption below 80° F. in terms of increased oil rate to secure equivalent results. From this curve it can be found, for example, that lowering the oil temperature from 80° to 55° F. is equivalent to a 50% increase in oil rate at 80° F. insofar as the butanes are concerned, but only 35% for propane, 24% for ethane and 17% for methane. This advantage of selective absorption is not available by other means of increasing plant capacity such as increased oil rate, lighter mol weight oil or increased pressures.

Cost Relatively Small

The costs of installing a refrigeration unit capable of subcooling the lean absorption oil by 25° F. are small in terms of equivalent oil rate. It would appear that such a unit might easily be justified in a new plant, especially where the volume of gas to be treated may be expected to remain relatively constant and the prospects of future additions to the plant are unlikely. It is also true where poor conditions of atmospheric cooling are obtained which would require an oil circulation that could not be justified when compared with the corresponding costs of using a lower oil circulation and installing propane refrigeration to secure the same results.

Benefits of refrigeration are more

easily appreciated in existing plants where it is necessary to increase the plant capacity for the purpose of extracting additional light hydrocarbons or to regain a plant efficiency that has been reduced due to additional load. Here the cost of installing the additional equipment for the necessary oil circulation (and additional plant units) can usually be shown to be much greater than that of installing a refrigeration unit to accomplish the same results. In addition the actual installation of a refrigeration unit is a simple problem and can be accomplished without the usual interference with the existing plant units.

In addition to the savings in first costs for a refrigeration system cooling the lean absorption oil, there is also a very definite savings in operating costs. The fuel requirements are practically limited to the engine fuel, which is nominal; while the fuel required to both heat and pump increased quantities of absorption oil would amount to considerably more. Also, the other operating and maintenance costs are low in comparison with the costs for the additional boilers, stills, pumps, exchangers and their auxiliaries.

Refrigeration units can be designed to maintain minimum oil temperatures where the plant is overloaded and can utilize the lowest temperatures secured in cold weather. Where the temperatures that can be secured under this arrangement are lower than necessary or where freezing or hydrate formation occurs, a back pressure valve, or temperature operated motor valve, can be installed in the vapor line from the chillers. In cases where constant plant operating conditions are desired a temperature controller on the oil will be useful. This may be especially true where the existing absorption plant is overloaded at some one point, such as the stabilizer. In such a case a controlled oil temperature may help maintain uniform vapor volumes and quality of products that would smooth out these plant operations.

In fact, the refrigeration unit complements the absorption unit unusually well since it supplies the maximum cooling when the atmospheric cooling is the poorest. When the atmospheric cooling is less efficient and the temperature of the lean absorption oil to the refrigeration system is relatively high there is an increased temperature difference between the oil and the propane that results in increased cooling. This additional cooling in turn increases the volume of vapors to be handled by the compressor and therefore raises the propane pressure and temperature, but not sufficiently to entirely offset the increased cooling. The fact that the compressors are more efficient with a higher intake pressure is advantageous to increased refrigeration. A compressor with clearance pockets has still higher ratio of efficiency at higher intake pressure. The resulting lowered compression ratio provides maximum refrigeration at those times when the absorption plant, with its atmospheric cooling, is the least efficient.

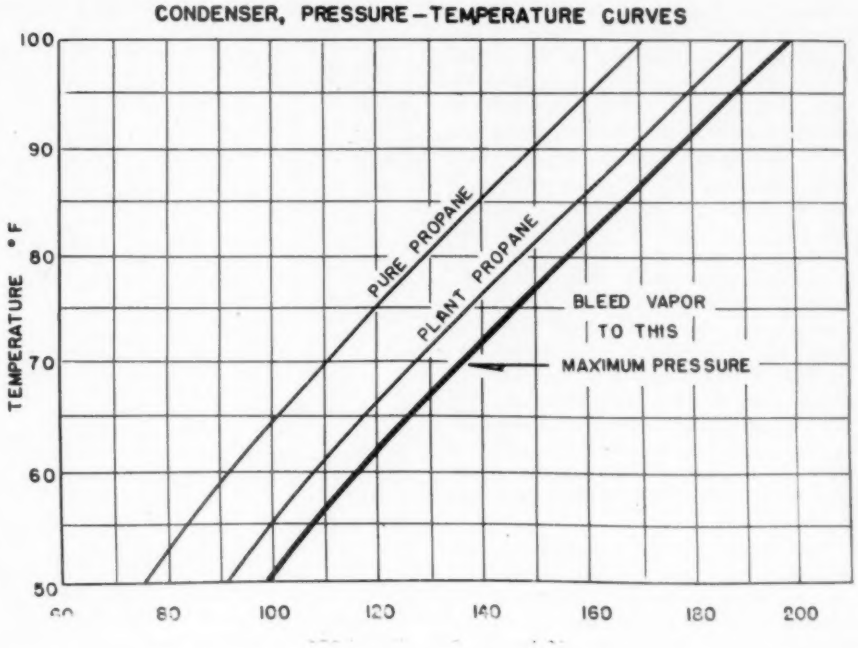

Fig. 2—Curves indicate allowable pressures for a given temperature secured by bleeding light fractions from propane

The refrigeration unit supplements the absorption plant in still other ways. First, the fat oil entering the plant exchangers on its way to the preheater is proportionally lower in temperature as a result of refrigeration. This increases the mean temperature difference within the plant oil to oil exchangers and lowers the lean oil temperatures to the plant coils. As a result these coils are required to extract less heat, and a closer approach of the lean oil to the water temperature is realized. This reduced lean oil temperature may be very appreciable in plants that are overloaded, as is often the case when new refrigeration units are to be installed. On the other hand, we have found relatively small increases in the heat load of the oil preheaters to the still.

Also, the residual dry gas content that is due to the vapor pressure of the light fractions in the lean oil is reduced. With the lowered oil temperature and corresponding drop in vapor pressure, there is a smaller loss of gasoline in the dry gas. This same factor would allow the use of a lighter mol weight absorption oil, resulting in increased absorption efficiency, since complete stripping in the plant still is not as essential.

Still another advantage of refrigeration results from the lowered dew point of the dry gas and the reduced water vapor content. As a result there is usually no condensation in the dry gas fuel lines. This allows better performance through decreased pressure drops and reduced corrosion problems.

Another benefit lies in the fact that propane liquid can easily be made available for other services. These may vary from laboratory refrigeration, to air conditioning, to overhead condensation in a stabilizing column or to wet gas cooling. Wet gas cooling is not too important in a low pressure plant since higher exchange rates can be secured on the oil side and it is generally economic to take the full subcooling at this point. However, for maximum refrigeration wet gas cooling is definitely economical.

The process design of a refrigeration plant is fundamentally very simple. By the use of some practical data the operating conditions in a propane refrigeration plant can be found to a degree of accuracy well within the range of the basic assumptions of future operating conditions in the plant. We also believe that any natural gasoline plant can secure a satisfactory propane refrigerant from the plant.

When appreciable amounts of ethane and lighter contaminants are in the feed to the refrigeration system it is advisable to vent sufficient vapor from the condenser accumulator to bring the refrigerant down to a point of reasonable purity. This venting, or bleeding, is in order to reduce the working pressures as well as the compressor horse power. By limiting the probable discharge pressure the compressor cylinder can be rated for greater capacity. Since the vapor to be bled is at the bubble point, it can be shown that relatively small quantities of vapor need be removed, with the best results secured by bleeding this equilibrium vapor slowly. (*See actual analysis data in Table* 1) For any temperature, vapor should be bled until the pressure is reduced to its allowable maximum. See Fig. 2.

We call the propane refrigerant that

reaches this vapor pressure limitation a plant propane. This is the type of material under consideration in this paper. Unless the propane feed is consistently very pure, the plant propane should represent an average propane refrigerant.

Another point that is important in considering the use of plant propane is the fact that the light ends in this refrigerant are flashed upon expansion into the chilling unit at a greater rate than the propane itself. The bulk of the propane requires additional heat before flashing into the vapor phase. As a result there is a greater proportional circulation of these light ends than there is of the pure propane. In actual operation the analysis that is secured at the intake to the compressors will show more of these light fractions than will be in the average propane in the chillers or in the system (Table 1.).

The extent of this condition is dependent upon the relative volume of propane in comparison with the vapor space in the same system and to the rate of circulation of the refrigerant. A large system and a light load could easily result in a circulation of much higher percentages of light ends than would be secured at high circulation rates. The analysis we have used for plant propane takes into consideration the effect of the average rate of the circulation of these light ends and can be used for typical operations without unreasonable errors.

From these analyses, previous curves and data, a practical Mollier diagram has been developed (Fig. 3) which has been adjusted for actual operating values. This enthalpy chart shows the amount of heat in a pound of the plant propane plotted against pressures, with lines of constant temperatures shown between the lines of saturated liquid and saturated vapor. These have been corrected for the light ends in the plant propane mixture so that they follow a curve of boiling points between the saturated liquid and vapor limits.

From this diagram it is possible to determine the relative amount of heat and the pressures and temperatures that can be expected at any point in the operation. The diagram will show the amount of heat to be removed in the condensers, the effective cooling available in the chillers, the theoretical horse power of compression and many more important values. In fact, it will be the engineers "Bible."

Included is a typical flow diagram for a refrigeration cycle on lean oil subcooling (Fig. 4). This is offered as a guide to the general nomenclature and as a basis for more detailed discussion on the design of various units. This arrangement is not recommended as preferable to others.

For example, our condensers are fabricated pipe coils, but actually open sections or a closed condenser would be just as suitable. Also, the run-down accumulator can be designed for greater capacity and allowed to take any fluctuations in the liquid propane in the system. In such a condition the level con-

TABLE 1—Propane Analysis

Analysis—Mol %	"A"	"B"	"K"	"D"	"E"	"F"
Carbon Dioxide	2.10	0.30	7.00	0.00	0.15	0.10
Methane	7.35	0.51	14.41	0.00	0.19	Trace
Ethane	7.69	2.88	2.67	0.04	2.33	1.23
Propane	82.70	95.95	0.86	98.54	96.95	98.30
Iso-Butane	0.16	0.36	0.44	1.03	0.38	0.37
Normal Butane	0.00	0.00		0.39	0.00	Trace
Total	100.00	100.00		100.00	100.00	100.00
Specific Gravity	1.421	1.531		1.551		

Remarks
"A"—Condenser Accumulator Vapor—172 psi abs., 79° F.
"B"—Condenser Accumulator Liquid—172 psi abs., 79° F.
Plant Propane before any bleeding—vapors to compressor.
"K"—Equilibrium Constants, "A"/"B".
"D"—Liquid in Chiller—lube oil removed.
"E"—Condenser Accumulator Liquid—162 psi abs., 79° F.
Plant Propane after bleeding approximately 10% off "B".
"F"—Plant Propane from Signal Hill Plant.
Specific Gravity taken by Edwards Balance.
"A" to "D" samples secured at Huntington Beach before bleeding.
"E" samples secured at Huntington Beach after bleeding.

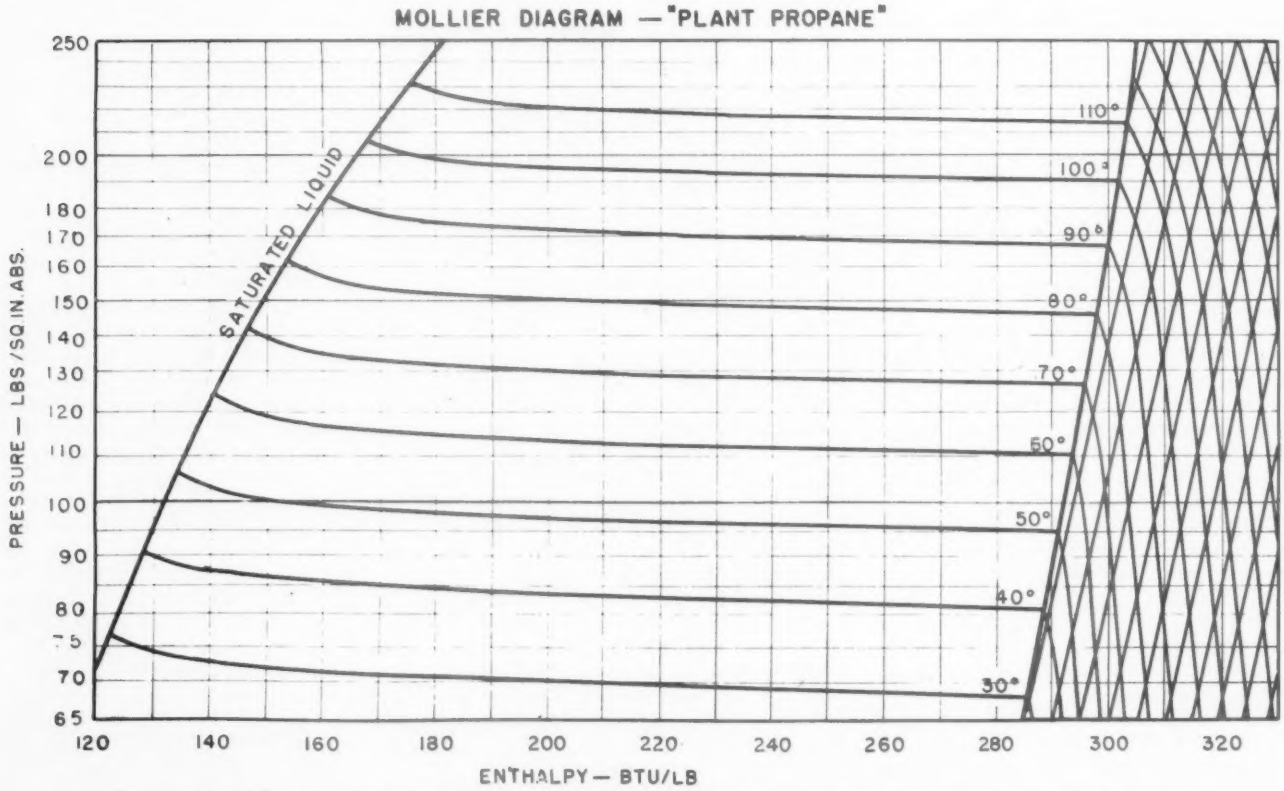

Fig. 3—Mollier diagram for Plant Propane based on pure propane and adjusted for operating data

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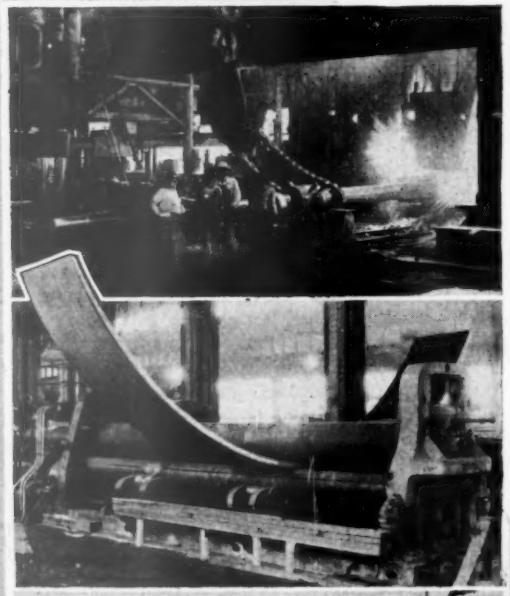

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trol would be on the chiller unit instead of the accumulator. It is important to study the condenser under conditions of poorest cooling to determine the value of added surface against the horse power of compression The Mollier diagram will show the temperature-pressure relationship in the condensers and the special curve (Fig. 2) should show these values even more clearly. This change in pressure with the condenser temperature must be used in determining the relative values of added surface and additional compressor capacity.

Oil chillers are generally constructed in one of two types. First, a chiller without any vapor space in it which operates in conjunction with a surge tank. Second, a type with a vapor space that allows a level to be maintained within the unit. In either case the size of the chiller should be balanced against the compressor capacity, since within reasonable economic limits the same cooling can be secured by either means.

The lubricating oil from the compressor cylinders must be removed from the system before its volume builds up to the point that temperatures are affected or the liquid begins foaming. It is not felt to be economic to take any steps to remove the oil from the vapor at the compressor discharge since sufficient oil will probably get by and into the liquid propane to require its removal at this point.

Actually a pure mineral lubricating oil offers no operating problem and a deoiler can easily be installed to accomplish its removal before any excessive concentration is possible. A side stream of the oil or other material to be cooled may be used for heating and, since the cooling effect of the propane may be utilized, there is no economic reason for not designing the deoiler rather liberally. It must be remembered too that the lube oil level must be kept low since the foaming oil will otherwise carry over with the vapors.

The utility and design of the superheater deserves much consideration. This unit not only superheats the vapor and prevents condensation during compression but at the same time the subcooling increases the refrigeration in terms of horse power per unit of cooling. With an impure, or plant propane, there is an additional advantage that can be secured from this subcooling. A study of the enthalpy chart will show that subcooling the liquid will reduce the quantity of flash upon expansion and at the same time will also reduce the flash temperature of the plant propane. If the chillers are designed to take advantage of this reduced temperature, and the increased temperature difference that can result, greater refrigeration can be secured without any change in operating pressures. This will increase the net refrigeration and offers some very interesting economic possibilities, especially if the available horse power assigned to this service is limited.

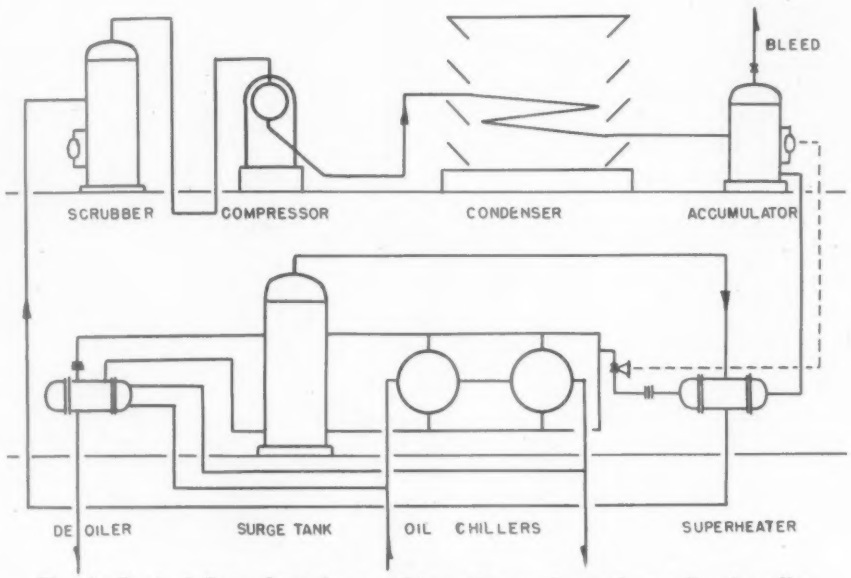

Fig. 4—Typical flow sheet for a refrigeration cycle on lean oil subcooling

We believe that the complete unit should be designed for 250 psi or the equivalent working pressure required for plant propane storage. Safety valves will be set to work at this pressure but except for fire they should never operate. With this allowable working pressure even the engines can be shut down without the necessity of releasing any of the propane from the system. The knowledge that the failure of any of the controls, or of the compressors, cannot cause a hazardous condition to materialize, allows a very healthy feeling of security on the part of all concerned. The cost of this added safety is nominal.

Design and Equipment of Propane Refrigeration Units in Two Plants

The preceding article discusses the principle of using propane refrigeration to increase absorption plant capacity.

Here is the description by the same authors of direct applications in two West Coast natural gasoline absorption plants . . . design and construction details, operating data and pertinent features of the equipment used.

PROPANE refrigeration units have been added to two of the Signal Oil and Gas Co.'s low pressure absorption plants during the last year. At Signal Hill this allowed one plant to efficiently handle the wet gas previously treated in two plants. At Huntington Beach the addition was required to allow the plant to maintain its efficiency with the increased volumes of wet gas to be processed. The two units are naturally somewhat similar in their flow but differ considerably in their construction, especially in the case of the oil chillers (Figs. 5 and 6). Both plants have chillers on the total plant production as it is being pumped into the raw feed tank for the stabilizer. In addition, the Huntington Beach plant has a chiller on the natural gasoline and uncondensed vapors from the still run down condensers (Fig. 9).

Both plants better their estimated performance and have provided no unforeseen operating problem or hazard. A set of operating and performance data for the plants is included in Table 2. In general these are in good agreement with the Mollier diagram (Fig. 3) in preceding article. For further comparison a set of the enthalpy data for Huntington Beach is given in Table 3.

The data taken from the Mollier diagram agrees with the actual test data very closely except for the compressor performance. In this case the Mollier diagram gives a 108° F. discharge temperature while it was actually 125° F. Also, the 15 Btu/lb. for the theoretical work of compression is too low a value. Both differences are due primarily to the fact that our intake and discharge pressures are secured from pipe line connections. Actually, the pressure losses through the compressor valves will result in a lower intake and a higher discharge pressure within the cylinder and therefore a greater ratio of compression and increased theoretical horsepower.

Since the ratios of compression for this work are generally about 2.0 or less, a small change in either pressure can result in a relatively large percentage increase in horsepower Also, the jacket cooling water is generally warmer

than the propane to the cylinder and therefore gives up heat in the cylinder and heats rather than cools the vapor.

This difference in readings is typical and must be considered in any design before any value is accepted for the compressor horsepower. The actual horsepower required to compress propane is less than generally required for natural gases due to the relatively low ratio of specific heats (1.17). For this reason one of the more generally accepted curves of horsepower per 1000 Mcf/day for different ratios of compression can be used.

Other points of interest in connection with the compressors include the use of a non-return or a check valve, which should be installed on the discharge of the compressor. We also feel it is better to install the compressor intake line so that it rises and makes a 180° bend with the shut off valve on the riser. This reduces the possibility of liquid accumulating above the intake valve during periods when the compressor is down (Fig. 7). In cases where the shut off valve must be placed in a position that would allow the accumulation of liquid between the valve and the header it is very important to install a bleeder that will permit complete drainage of any liquid before the engine is started.

There are a number of advantages favoring the use of a slightly oversize compressor cylinder and then bringing it down to the desired operating range by the use of clearance bottles. The most important is the flexibility that is offered. This not only allows the correct capacity for the calculated design conditions to be secured but will allow a clearance adjustment to be made at any time to meet further or changed operations over a wide range of conditions. Also, clearance pockets have less effect on the cylinder capacity at low compression ratios such as exist under the higher intake pressures and higher loads. For this reason when the atmospheric cooling is the poorest and the chillers are producing the greatest cooling effect, the compressor cylinders are handling this increased volume of propane with the highest relative efficiency. This is an ideal situation since it allows the greatest load to result at those times when the value is greatest and higher horsepower can be justified.

The condensers in our plants are pipe coils designed for the necessary drainage to handle full condensation without unnecessary pressure drop. It can be seen from the Mollier diagram that there will be a relatively large mean temperature difference (MTD) between the cooling water and the propane except for the last 10% or less when the plant propane temperature curve swings up as a result of the light hydrocarbons which reduces the temperature difference very materially. Actual test data indicate that half the heat of condensation was done in the first 30% and two thirds in 50% of the coil.

In the Huntington Beach plant the oil chiller was designed to utilize the range in boiling temperatures available in a plant propane at a constant pressure. The oil chillers at this plant consist of one 39 in. x 65 ft. and two parallel 25 in. x 65 ft. long units in series flow. The propane is expanded into one end of the 39 in. chiller and travels its length before it overflows a weir that maintains the level of the propane and flows into the other chiller. The chillers are piped for counter flow. The propane temperature increases about 5° between the point of expansion and the end of the chillers. These changing temperatures can be checked on the Mollier diagram and are obviously worth consideration as a means of increasing the MTD and therefore the actual cooling.

These chillers at Huntington Beach

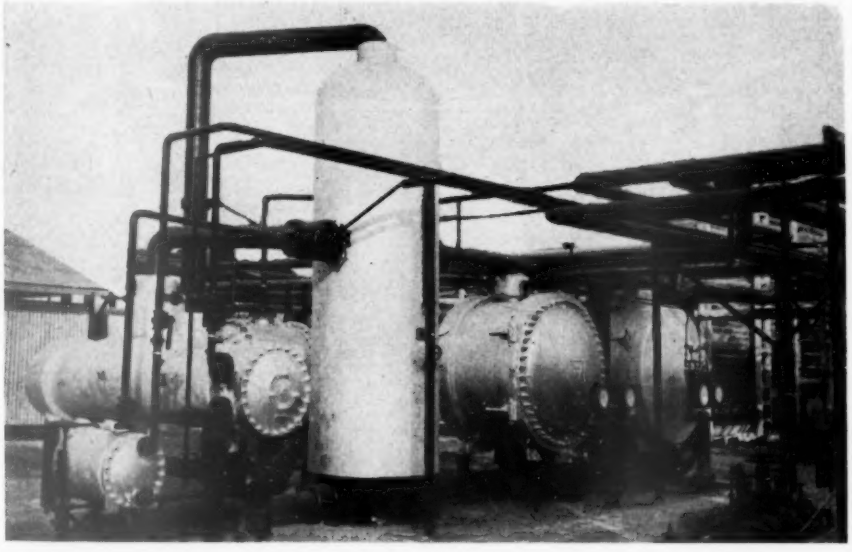

Fig. 5—Signal Hill refrigeration unit: Left to right, oil chillers, propane surge tank, raw gasoline chiller and deoiler

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make use of standard 1 in. pipe for tubes and were fabricated in place. These pipe tubes were placed in the lower two thirds of the shell, which leaves the top third for vapor space. We also utilize these oil chillers for the small amount of working storage that is necessary to avoid adding propane more often than necessary. The minimum level of propane for efficient operation is indicated by a super-heating of the vapors as a result of the direct contact with the tubes as the level drops too low. This minimum efficient level can be determined definitely if thermometers are installed in both liquid and vapors. This will then give a reliable minimum level that can be indicated by a gauge glass reading during normal operation.

At Signal Hill, commercial exchange units were installed, which have performed satisfactorily. However, with this type of design there is no means of taking efficient advantage of the lower flash temperature and slightly greater surface is required for the same refrigeration. The economic choice between these two types of cooler will depend upon individual conditions and this can be decided after considering both possibilities.

The deoiler must secure its feed from the point where there will normally be the greatest concentration of lubricating oil in the system. At Signal Hill where the propane is in constant circulation the supply is taken from the surge tank. (Fig. 8) At Huntington Beach the propane enters at the end of a long horizontal chilling unit and flows lengthwise through this unit. For this reason the lubricating oil will become concentrated at the end of the unit and the feed for the deoiler is taken from this point of greatest concentration. In this plant where the design allows the lubricating oil to concentrate within the system, the problem of removing the oil is obviously simplified.

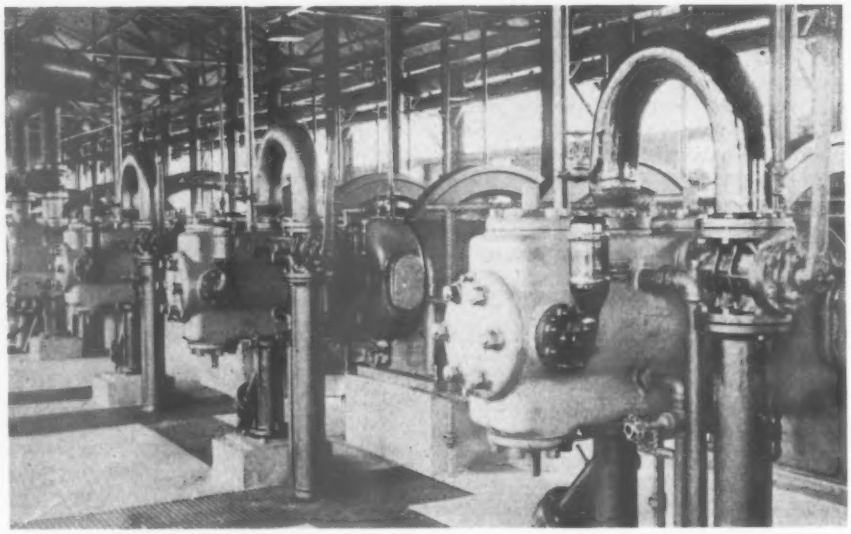

Fig. 7—Propane compressors at Huntington Beach plant

At Huntington Beach we have chillers on both our run down gasoline and uncondensed vapors and on the raw production into the stabilizer feed tank (Fig. 9). These units are independent of our oil chillers and are located in another area of the plant. Both are converted exchanger units and are connected top and bottom to a propane surge tank. A level control on the surge tank maintains an independent level in this tank. A small drain line to the deoiler is used to remove the lubricating oil that concentrates in this unit.

The chiller unit on the run down liquid and uncondensed vapors from the still condenser is used to control the volume of vapors which must be handled

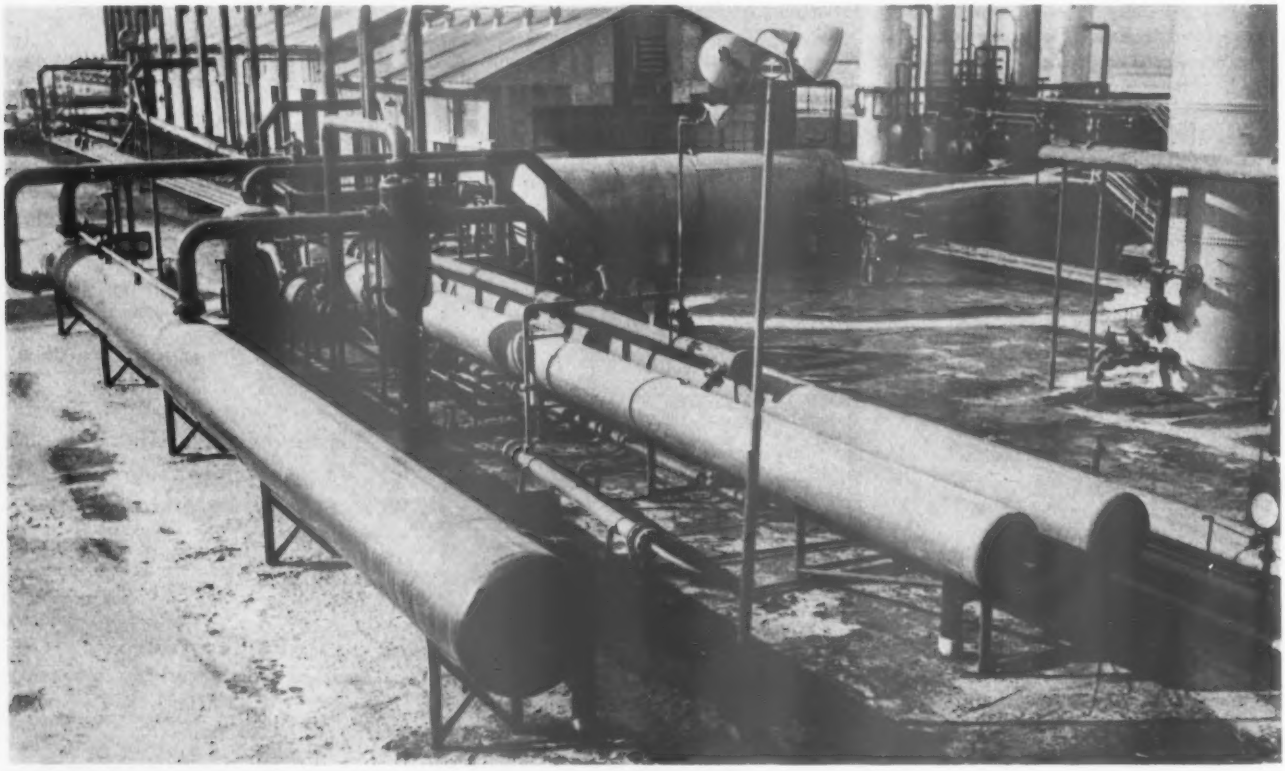

Fig. 6—Huntington Beach oil chillers: 39-in. x 65-ft. unit at left is the final oil chiller in series, with the two 25-in. x 65 ft. chillers on the right. The deoiler, superheater and scrubber are shown between the two chiller units

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by the vapor compressor. The other chiller unit is on the plant production to the stabilizer feed tank and in this case the cooling permits a lower pressure for separation of the excess light fractions. This lower temperature allows a better separation of the light hydrocarbons because of their relatively smaller reduction in vapor pressure at these colder temperatures. The amount of cooling on each chiller is regulated manually by an occasional adjustment of the valve on the vapor line out of the exchanger and into the surge tank.

The addition of these two chillers allowed us to continue with the same vapor compressor as existed in the plant before the addition of the refrigeration unit and the resulting increased extraction of light hydrocarbons. It was found that the refrigeration horsepower necessary to reduce the vapor volume and lower the discharge pressure is approximately 60% of the horsepower that would have been required to handle the additional vapors without this refrigeration. The 40% of horsepower saved is available for additional refrigeration.

TABLE 3—Enthalpy Data For Huntington Beach Plant

	Btu/lb
Compression	
Inlet vapor—94 psi abs., 61° F	296
Discharge—174 psi abs., 125° F	309
Work of Compression	—15
Condensation	
Inlet—173 psi abs., 117° F	313
Outlet—171 psi abs., 85° F	157
Heat of Condensation	156
Superheater	
Liquid in—171 psi abs., 85° F	157
Liquid out—Sat. liquid, 80° F	153
Subcooling	4
Refrigeration	
Liquid in—98 psi abs., 48° F	153
Vapor out—98 psi abs., 53° F	292
Net Refrigeration	—139

TABLE 2—Operating Data for Signal Hill and Huntington Beach Refrigeration Units

	Signal Hill	Huntington Beach
General		
Oil Rate—1000 Gals/Day	585	1,110
Natural Gasoline—Gals/Day	28,500	45,500
Propane Refrigerant		
MCF/Day	3,260	5,520
LBS/Hr.	15,800	27,000
Gal/Min.	62	105
Condensers		
Surface (O.D.)—Sq.Ft.	3,670	5,810
Pressure, psi. abs.—in	152	173
Pressure, psi. abs.—out	148	171
Temp. °F.—in	106	117
Temp. °F—out	76	85
Superheater		
Surface (O.D.)—Sq.Ft.	385	250
Temp. °F.		
Vapor—in	46	53
Vapor—out	58	60
Liquid—in	76	85
Liquid—out	67	80
Oil Chillers		
Surface (O.D.)—Sq.Ft.	2,660	7,650
Propane—Gal/Min.	...	93
Pressures, psi. abs.		
Oil—in	92	72
Oil—out	84	65
Chiller	88	98
Temp. °F		
Oil—in	74	73
Oil—out	49	53
Propane—Flash	...	48
Propane—Final	...	53
Propane—Surge	46	...
Gasoline Chillers		
Surface—Sq.Ft.	450	450
Pressures, psi abs.		
Gasoline—in	105	105
Propane	88	105
Temp. °F.		
Gasoline—in	87	82
Gasoline—out	63	60
Propane	46	55
Compressors		
Pressures, psi. abs.		
Intake	87	94
Discharge	152	174
Compression Ratio	1.75	1.85
Temp. °F.		
Intake	58	61
Discharge	113	125
Engine cooling water	110	110
Remarks		
One third additional compressor capacity is being installed at Huntington Beach.		

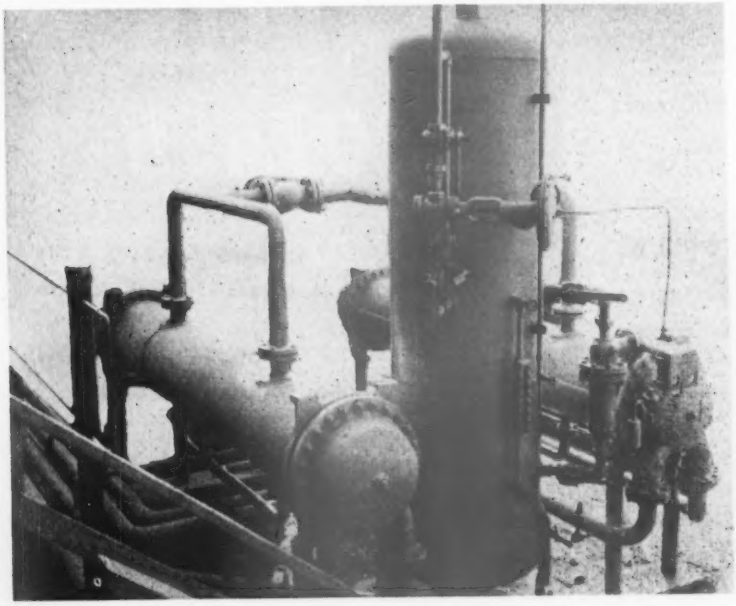
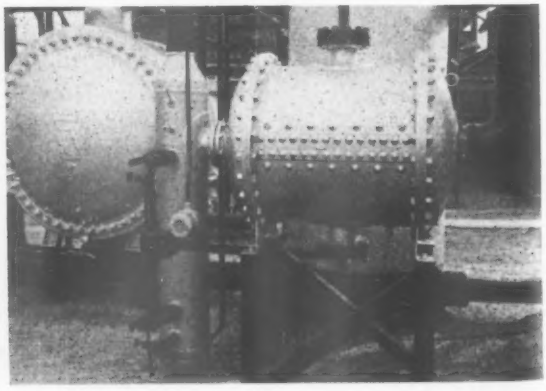
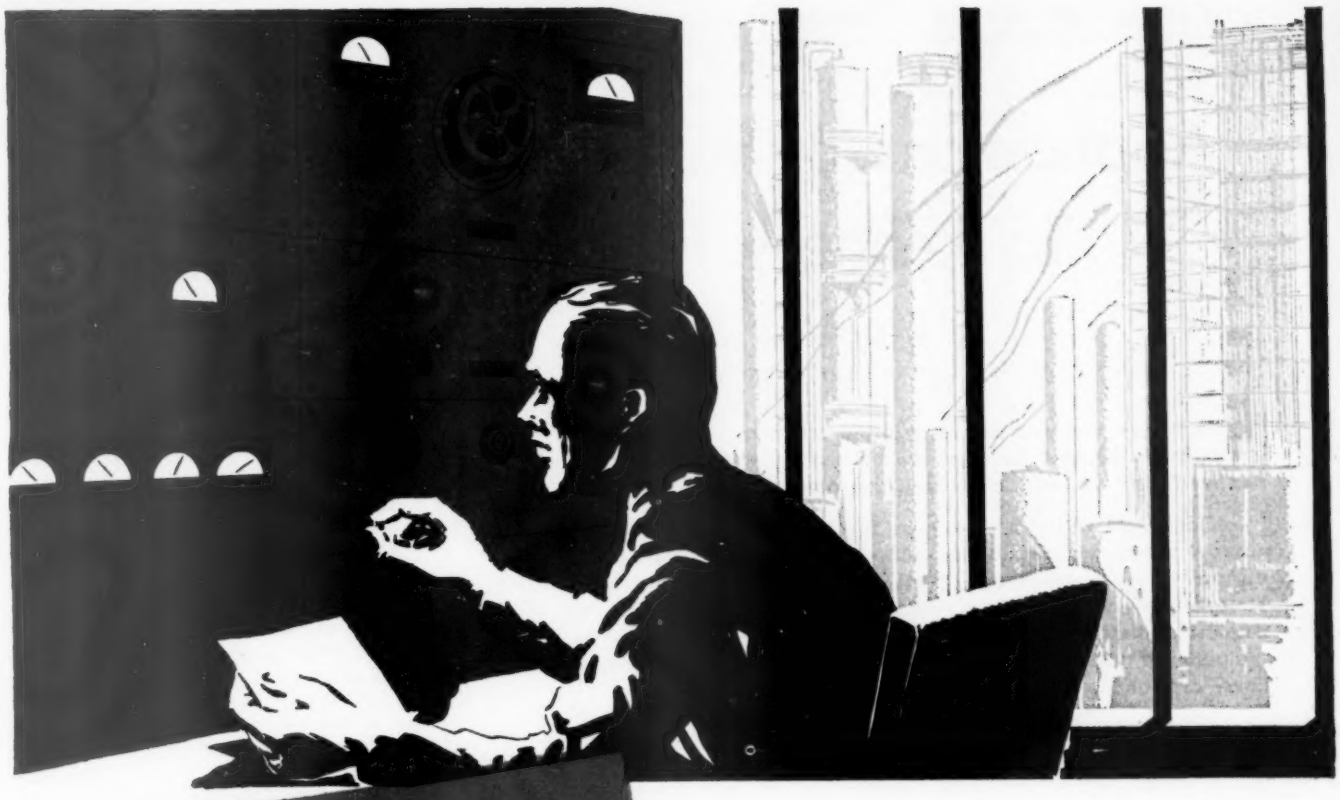


Fig. 8 (below)—Signal Hill superheater and scrubber. The surge tank actually serves as a scrubber in this plant so that this unit serves as a means of installing a float and the magneto ground

Fig. 9 (left)—Huntington Beach gasoline chillers; note separate surge tank and level control for semi-independent operation





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b. **Pilot Plant and Exploratory.** This work included an intensive development program on procedures for the analysis of C_5, C_6, C_7 and C_8 hydrocarbons.

RESULTS OF ONE YEAR OF OPERATION

Distribution of Samples	
Plant Control & Study of Plant Process	50%
Pilot Plant and Exploratory	50%
Plant Operations Involved	
Fractionation	
Thermal Cracking	
Catalytic Cracking	
Alkylation	
Catalytic Polymerization (Cumene & Codimer)	
Types of Samples Analyzed	
C_3 through C_5 (including fixed gases)	
C_6 fractions	
C_8 fractions	
Hexane Mixtures	
Heptane Mixtures	
Octane Mixtures	

Samples analyzed per month (avg.)	235
Instrument operating time, per month	275 hrs.
Personnel time, per month	1250 hrs.
Instrument shut-down time, per month (repairs, maintenance, etc.)	20 hrs.

BEST MONTH OF OPERATION

No. of samples analyzed	400
Instrument operation time	400 hrs.
Personnel time (operating & computing)	1200 hrs.

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Applications of the Mass Spectrometer To Refinery Process Control

By W. S. Young
Research and Development Dept., Atlantic Refining Co.

This "how-to-do-it" article is based on more than 8000 analyses of hydrocarbon mixtures by mass spectrometry—the main application of this relatively new type of laboratory apparatus.

Pioneering in the use of mass spectrometry for process control purposes in petroleum refining, the author's company has found the instrument adaptable to operation on a routine basis for such applications as: fractionation, where analysis of overhead products constitutes one of the simplest analytical problems; cracking, where the instrument is used to evaluate the potential availability of the gas stream to other plant operations; alkylation, polymerization, and other applications.

For adaptability to mass spectrometer analysis, hydrocarbon mixtures are classified in two groups: those directly suitable; and those which must first undergo low-temperature fractionation to remove compounds not determinable by mass spectrometry or to concentrate certain components.

Special operating techniques are described; and suggestions are given for the operation and maintenance of the apparatus.

TWO and one half years of continuous operation has shown the mass spectrometer to be an instrument capable of analyzing both efficiently and accurately a wide variety of the gas and liquid mixtures commonly encountered in gasoline refinery practice. During this period nearly 8000 analyses have been performed on the instrument for purposes of refinery control and survey, pilot plant operation and laboratory research.

The experience thus gained has been of immense value in placing mass spectrometer operation on a routine basis whereby advantage could be taken of many operating and computational shortcuts, and in developing time-saving procedures which enable unusual or special samples to be handled with a minimum disruption of customary routine.

At present there are a large number of refinery control analyses associated with the manufacture of gasoline to which the mass spectrometer has been successfully applied. In the field of laboratory research, where the problems are considerably more diversified, the instrument is proving itself an indispensable aid for both qualitative and quantitative organic analysis.

Subsequent discussion will concern itself primarily with the application of the instrument to analytical problems closely connected with refinery process control. Inasmuch as descriptions of the instrument, its operating principles and computational techniques are already adequately covered in the literature(1-7) no attempt will be made to repeat this material here.

General Considerations

Experience has shown that mixtures which are suitable for mass spectrometer analysis can be divided into two classes:

First; those hydrocarbon mixtures which can be analyzed directly with no preliminary treatment. In this class are lean gases, rich gases in which the C_6 and heavier components are present in concentrations below 2-3 mole percent, liquid mixtures including the C_8 boiling range which are relatively narrow cuts containing fewer than 10 components, gas or liquid mixtures in which only certain key components need be determined, and a considerable number of non-hydrocarbon compounds associated with refining operations such as H_2, air, CO_2, CO, H_2S, SO_2 and mercaptans either alone or admixed with hydrocarbon gases or liquids.

Second; those gas or liquid mixtures which first must be subjected to a low temperature fractionation designed either to lower the C_6 and heavier content of the gas fraction to an acceptable level, or to concentrate certain components of the mixture in the interest of greater accuracy. In this category fall some rich gases, fractionating tower feeds and bottoms, flash drum products, naphthas where C_5 and C_4 isomers are to be determined, and naphthas which must be split up by high temperature fractionation into narrow fractions for the determination of C_5, C_6, C_7, and C_8 isomers. This latter analysis is limited to the paraffins, naphthenes and aromatics found in the C_6 to C_8 boiling range.

Olefins higher than the C_5 isomers cannot at present be determined by the mass spectrometer because of the lack of a sufficient number of pure compounds for calibration purposes. These olefins must therefore be removed from the mixture, usually by chemical means, before an analysis for other components can be accomplished.

From these general remarks it should be apparent that the mass spectrometer is capable of performing unaided a variety of analyses important to plant control. Furthermore, when supplemented by other physical and chemical methods its use may be extended, with the exception of higher olefins, to the complete analysis of gasoline refinery streams including the octane boiling range.

Specific Process Applications

Fractionation

Owing principally to the relatively small number of components usually present, the analysis of overhead products from refinery fractionation units generally constitutes one of the simplest analytical problems for the mass spectrometer. Such products, whether obtained from deethanizers, depropanizers, debutanizers or depentanizers operating either on crude, natural gasoline or cracked stocks, may all be analyzed directly by means of the mass spectrometer. When the analysis is to be used solely for control purposes involving only the determination of one or two key components answers may be obtained quite rapidly. Complete analysis of these overhead products, however, takes somewhat longer, particularly in the case of debutanizer or depentanizer operation with cracked stocks where the determination of several olefinic components is required.

Fractionating unit feeds and bottoms, on the other hand, present a more complex problem. Here the high concentrations of C_6 and heavier material ordinarily present render the direct analysis impracticable, so that a preliminary stripping operation must be carried out in order to separate the C_5 and lighter gas from the heavier components. This stripping operation, performed in conventional low temperature distillation equipment, need be only a rough fractionation designed to lower the C_6 and heavier content of the gas fraction to a few percent, a concentration acceptable for spectrometer analysis. The gas fraction, thus prepared, is then analyzed directly on

the spectrometer in the usual manner, and the results combined with those of the stripping operation to obtain an analysis on the basis of the original sample.

This general method may also be extended to the analysis of naphtha streams well into the octane boiling range, but here the preliminary distillation must be carried out in high temperature fractionating columns of 60 or more plates, and considerably more care must be exercised than in the previous example because of the necessity for preparing fractions containing fewer than 10 components. In addition, the naphtha must be treated chemically, preferably before distillation, to remove olefins which if present in the separate cuts would seriously interfere with the mass spectrometer computations. At present the time consumed in making such an analysis is considerable and as yet the operations are not on a routine basis, but the point is illustrated that the mass spectrometer is a tool well suited to the ultimate analysis of naphthas whose composition it was previously considered impracticable to determine.

Table 1 illustrates the partial analysis of a typical cracked naphtha in the boiling range of 177-221° F., which was fractionated into six cuts prior to mass spectrometer analysis.

TABLE 1—Mass Spectrometer Analysis of Cracked Naphtha

(Boiling range 177-221° F. Naphtha fractionated in six cuts before analysis)

Components	Vol. % Present
2,4-Dimethylpentane	0.360
3,3-Dimethylpentane	0.510
2,3-Dimethylpentane	3.46
2-Methylhexane	8.11
3-Methylhexane	10.4
3-Ethylpentane	0.255
n-Heptane	16.9
2,5-Dimethylhexane	0.225
2,4-Dimethylhexane	0.210
Cyclohexane	7.06
Dimethylcyclopentanes	17.2
Methylcyclohexane	26.5
Ethylcyclopentane	3.91
Trimethylcyclopentanes	1.30
Benzene	0.89
Toluene	2.71
Total	100.0

Thermal Cracking

The operation of thermal cracking units is rarely if ever controlled by the analysis of streams suitable for mass spectrometer analysis. Such control is ordinarily achieved by vapor pressure measurements and assay distillations. Nevertheless, information of importance in evaluating the potential availability to other refining operations of the normally gaseous hydrocarbons can be obtained by the analysis of various cracking streams. A direct mass spectrometer analysis can usually be obtained on separator or stabilizer overhead streams where the limit of 2-3 mole percent of C_6 and heavier components is not exceeded. Where heavier materials must be analyzed, as in the case of feed, side streams and bottoms, a preliminary low temperature stripping must be carried out on the mixture to separate the C_5 and lighter gas fraction.

Table 2 shows a typical stabilizer overhead composition obtained by direct spectrometer analysis, and also a stabilizer bottoms gas fraction analysis obtained after first stripping the C_5 and lighter components from the naphtha residue. It will be noted that the C_4 olefins have been reported as a total rather than as individual olefins. This is ordinarily done where a knowledge of the olefin distribution is not necessary,

HOW THE MASS SPECTROMETER WORKS

The mass spectrometer is so named because of its similarity to an optical spectrometer. The latter separates a light beam into its component monochromatic beams by deflecting shorter wave-lengths more than longer ones. The mass spectrometer separates a beam of moving gas molecules into distinct beams by sorting them according to their structure and type of atoms contained. The instrument is based on the well-known principle that a uniform magnetic field will deflect a stream of ions by varying amounts, depending on the charge, speed and mass of individual ions.

Basically, the instrument consists of a gas inlet system, ionization chamber, semi-circular analyzer tube, electrical recording mechanism and suitable evacuation equipment, as shown diagrammatically in Fig. 1.

The sample is admitted to the ionization chamber "A" where it is given a positive charge by electron bombardment. (In actual practice this bombardment is of such intensity that the molecules are broken into charged fragments, thereby permitting substances of identical molecular weight but of different structures—isomers—to be distinguished from each other.) These positively charged particles then are pulled out of the ionization chamber by means of a negatively charged electric field existing between electrodes "D", "E" and "F", and enter the analyzer tube "B" at a high linear velocity, imparted by the same electric field.

In the analyzer tube the particles are subjected to a uniform magnetic field, which, acting perpendicular to the radius of the curved tube, causes them to move in a circular path. The radii of curvature for these paths are smaller for the low masses than for the high ones, but by gradually lowering the electric field which produces the initial acceleration (still maintaining a constant magnetic field) the radii of curvature can all be simultaneously and continuously reduced during the course of a run. This means

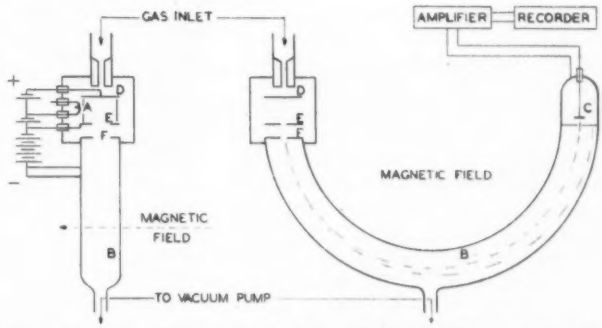
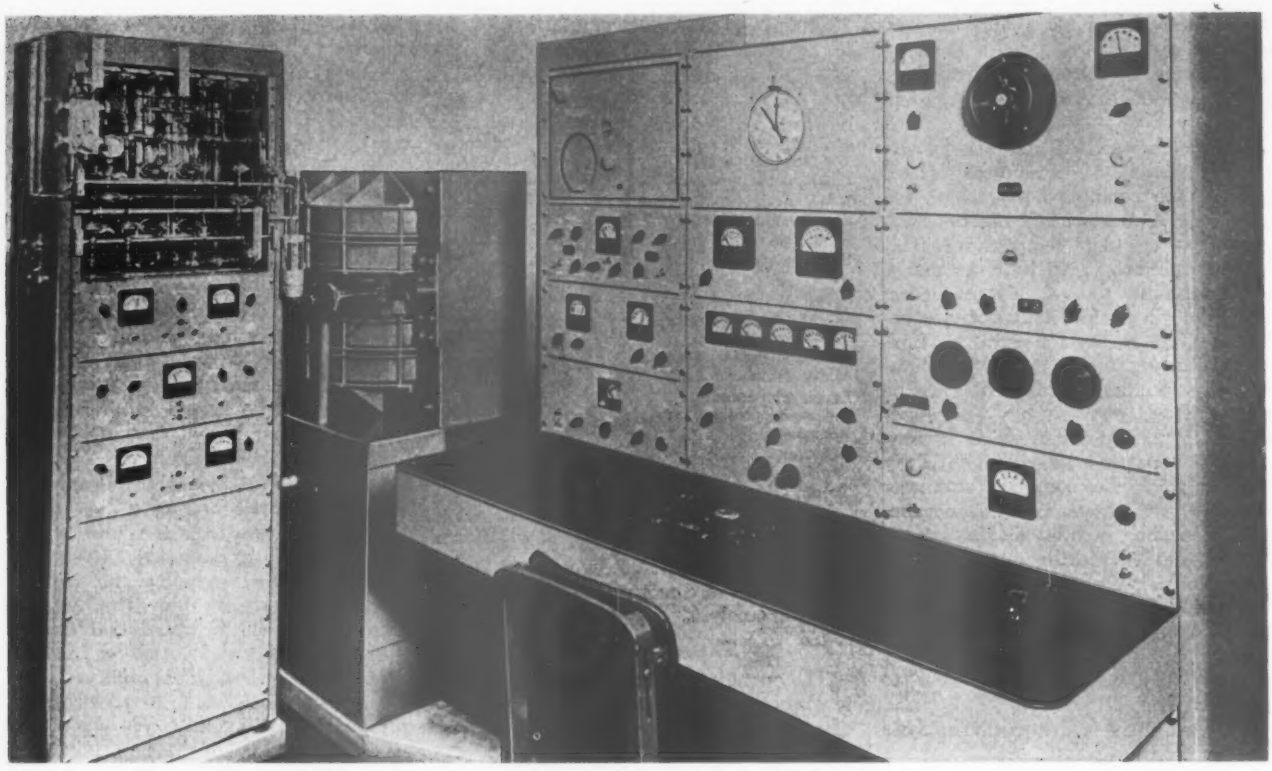


Fig. 1—Diagrammatic sketch of the main components of the mass spectrometer. The gas sample to be analyzed is introduced into the ionization chamber "A"; the positively charged particles are attracted into the negatively charged electric field surrounding electrodes "D", "E" and "F", and then enter the analyzer tube "B", under high vacuum and at high speed: a magnetic field, perpendicular to the analyzer tube, moves the particles in a circular path, so that those particles having the same radius of curvature as the tube will pass through a slit at the far end and hit the collector plate "C", from which they are amplified and recorded

that each particle in turn will have just the right radius of curvature to permit it to pass through the semi-circular analyzer tube and into a slit, at the other end.

Beyond the slit is a stationary collector plate "C" which, by means of amplifying and recording equipment, in effect counts the particles as they strike it. Thus, as a sample is introduced into the ionization chamber and the electric field at one end of the analyzer tube is varied, the "spectrum" of the material being analyzed moves across the collector plate at the other end of the tube in such a manner that each component registers successively through an amplifier and recording oscillograph.



Typical installation of a commercial spectrometer built by Consolidated Engineering Corp., Pasadena, Calif., and in operation at Atlantic Refining Co.'s Philadelphia laboratories. In the center background is the electromagnet which produces a uniform magnetic field in which the mass spectrometer proper is placed. Immediately to the left is the sample inlet sytem and evacuation apparatus. In the right foreground is the operator's table and rack which houses the automatic recording apparatus and power packs. These power packs supply closely regulated voltages to the spectrometer and electromagnet

and results in a considerable saving in computational time.

In order to obtain a reliable split between iso-butene and the normal butenes the sample analyzed should contain less than 1% of C_5 olefins, which means that the stripping operation must be carried out in such a manner that essentially a C_4 and lighter gas is obtained. If C_5 isomers are also of interest a second cut may be made from the same stripping distillation to isolate the C_5 fraction, which may then be analyzed on the spectrometer similarly to the C_4 and lighter fraction.

A more complete breakdown of the C_4 olefins into iso-butene, 1-butene and 2-butene can be accomplished by first preparing a C_4 cut by low temperature distillation which is essentially free of both heavier and lighter components, particularly olefins. This cut as well as the heavier and lighter cuts may then be analyzed by means of the mass spectrometer and the individual results combined to yield a total analysis. In this way complete analyses may be obtained of all paraffinic, naphthenic and olefinic components from methane through the C_5 hydrocarbons. Table 3 shows a typical analysis of a C_5 cut from deisopentanizer overhead.

TABLE 3—Analysis of C_5 Cut from Deisopentanizer Overhead

Components	Vol. % Present
i-Pentane	12.9
n-Pentane	9.5
Cyclopentane	2.1
Pentene-2	28.8
2-Methylbutene-1	4.1
2-Methylbutene-2	38.6
Cyclopentene or Pentadiene	1.5
Hexenes	1.2
Hexanes	1.3
	100.0

TABLE 2—Mass Spectrometer Analysis of Thermal Cracking Products

Stabilizer Overhead		Stabilizer Bottoms*	
Components	Mole % Present	Components	Vol % Present
Hydrogen	0.9	Propene	0.6
Hydrogen sulfide	0.1	Propane	1.0
Methane	16.4	Butenes	2.4
Ethene	6.5	iso-Butane	0.4
Ethane	21.3	n-Butane	2.1
Propene	16.7	Pentenes	3.8
Propane	18.7	iso-Pentane	1.7
Butenes	10.5	n-Pentane	2.5
iso-Butane	1.5	Hexanes and Heavier	85.5
n-Butane	5.5		100.0
Pentenes	1.1		
iso-Pentane	0.6		
n-Pentane	0.2		
	100.0		

* Preliminary stripping performed to separate C_5 and lighter gas fractions prior to mass spectrometer analysis.

Catalytic Cracking

Here, as in thermal cracking operations, primary control of the process is ordinarily achieved by means other than the analysis of gas streams. However, as a means of determining production of such important by-products as propylene for cumene manufacture, B-B feed for alkylation, and isopentane for gasoline blending the mass spectrometer can be a valuable tool. On the other hand, control of fractionating tower operation can be achieved readily by the spectrometer in the manner outlined previously under Fractionation. Table 4 shows typical analyses of propylene and B-B streams, and in these cases the compositions were such as to permit direct analysis with no preliminary stripping operation.

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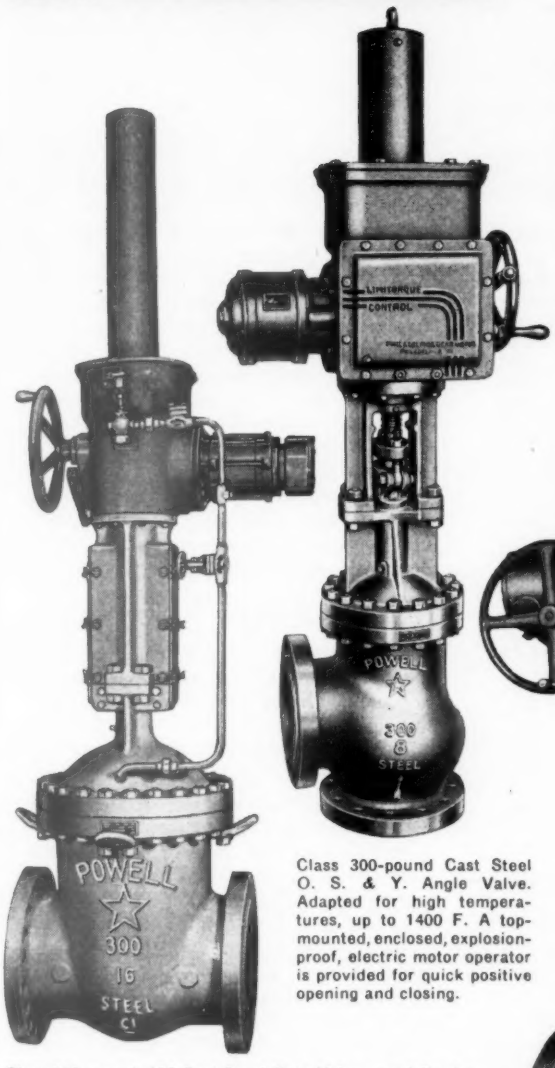
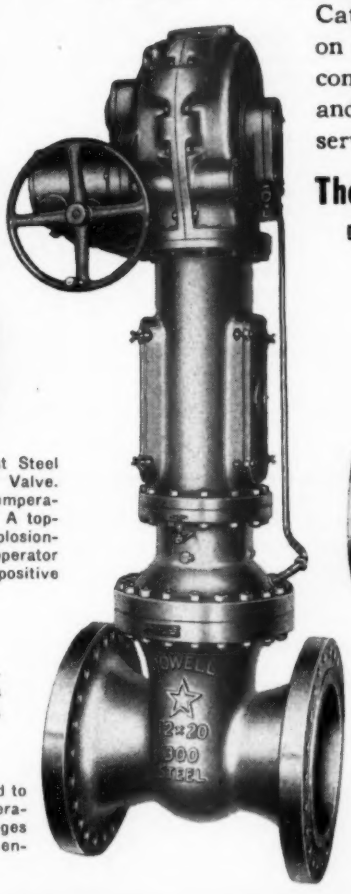
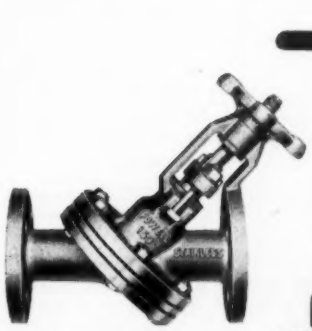


Class 300-pound, 16" Cast Steel Gate Valve, specially designed for producing 100 octane aviation gasoline. Has automatic steam sealing mechanism and top-mounted, enclosed, explosion-proof, electric motor operator.

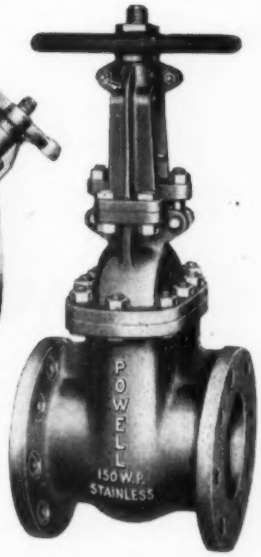
Class 300-pound Cast Steel O. S. & Y. Angle Valve. Adapted for high temperatures, up to 1400 F. A top-mounted, enclosed, explosion-proof, electric motor operator is provided for quick positive opening and closing.



Class 300-pound Cast Alloy Steel Gate Valve, designed to meet special requirements and to handle high temperatures. Has 12" port size venturied to 20" size end flanges to accommodate insulated pipe. Also top-mounted, enclosed, explosion-proof, electric motor operator.



150-pound Stainless Steel Separable Body, Reversible Seat "Y" Valve. Lower half of body can be unbolted and turned through an arc of 180 degrees to make a 90-degree angle valve.



150-pound Stainless Steel, Flanged End, O. S. & Y. Gate Valve.

POWELL VALVES

TABLE 4—Mass Spectrometer Analysis of Catalytic Cracking Products

Propylene Stream		B-B Stream	
Components	Mole % Present	Components	Mole % Present
Hydrogen	2.7	Propene	1.7
Hydrogen sulfide	4.3	Propane	5.6
Carbon dioxide	1.8	iso-Butene	11.5
Methane	13.3	n-Butenes	26.1
Ethene	5.0	iso-Butane	37.0
Ethane	16.6	n-Butane	16.2
Propene	36.5	Pentenes	0.8
Propane	19.8	iso-Pentane	1.1
	100.0		100.0

spectrometer applied to the control of alkylation processes lies in the rapidity with which it can successfully analyze B-B and isobutane feed streams and overhead products from the associated fractionation system. Examples of similar streams have already been illustrated in Tables 2 and 4.

Although at present little can be done to control alkylation processes from a complete alkylate analysis, much information useful for research purposes may be so obtained. The analysis of alkylate through the octane region is a comparatively simple matter for the mass spectrometer because of the virtual absence of olefinic, naphthenic and aromatic compounds. The technique of analysis consists of a preliminary breakdown of the alkylate by fractionation into cuts containing fewer than 10 components followed by a mass spectrometer analysis of each cut. Such an analysis is illustrated in Table 5 after the results have been recombined on the basis of the total sample.

Polymerization

As in alkylation, control of polymerization processes by mass spectrometer analysis must be based on analyses of feed and product streams and tower control by analysis of overhead products either completely, or for key components as the case requires. The principles remain the same as previously outlined, i.e., if the stream contains little or no C_6 and heavier components it can be analyzed directly by the mass spectrometer; if an appreciable quantity of this heavy material is present a preliminary stripping operation is necessary for an analysis of the gas fraction. Table 6 shows an analysis of a polymerization plant tail gas which was performed directly, and an analysis of a rich oil stream containing only 10% of C_5 and lighter components obtained after a preliminary stripping operation was performed to concentrate the gas fraction.

Operating Techniques

Time Saving Procedures

In the past considerable operational time was consumed in the manipulation of liquid samples prior to their introduction into the spectrometer, because of the necessity for having an accurately known quantity for computational purposes. At present, however, the use of sintered glass valve techniques[8] makes possible the introduction of such liquid samples as rapidly as the ordinary gas sample. In addition, the use of other recently developed methods and the further extension of the sintered glass valve has considerably shortened the time required for introducing gas samples from standard Orsat tubes.

TABLE 5—Mass Spectrometer Analysis of C_4 Alkylate

Components	Vol. % Present Based on Total Alkylate
n-Butane	0.34
Neopentane	0.06
Isopentane	8.02
Pentenes	0.09
n-Pentane	0.35
2,3-Dimethylbutene	4.84
2-Methylpentane	1.02
3-Methylpentane	0.42
2,2-Dimethylpentane	} 0.25
2,2,3-Trimethylbutane	
2,4-Dimethylpentane	3.55
2,3-Dimethylpentane	2.32
2-Methylhexane	0.18
3-Methylhexane	0.15
2,2,4-Trimethylpentane	} 24.4
2,2-Dimethylhexane	
2,5-Dimethylhexane	4.48
2,4-Dimethylhexane	2.70
2,2,3-Trimethylpentane	1.21
2,3,4-Trimethylpentane	12.4
2,3,3-Trimethylpentane	11.5
2,3-Dimethylhexane	0.91
Higher boiling compounds	20.8
	100.0

If the mass spectrometer is not in 24-hour operation it has been found that a large proportion of the time previously consumed during "warm-up" periods can be saved by placing the instrument on automatic operation during times when it is not in use. Under automatic operation either an actual sample or some pure gas is allowed to flow through the instrument with all circuits and controls, except the camera, set and working just as in actual operation. To accomplish this a synchronous motor and cam arrangement has been designed to sweep the entire spectrum once every 15 minutes thus simulating normal operation. Under these conditions the instrument is ready for instant use at all times and needs no "warm-up" period prior to operation.

Probably the most significant saving in time may be realized by placing computations on a routine basis wherever possible, and by computing only those components of a mixture which are significant for the purpose at hand. Usually, the large number of samples analyzed by the spectrometer may be divided into a relatively few categories defined primarily by approximate composition. These sample categories are studied and short-cut methods of computation developed which are applicable to all samples falling into one or the other of the categories. By thus taking advantage of these short-cuts wherever feasible much computational time may be saved which otherwise would be spent on the longer conventional methods.

Avoid Excessive Maintenance

In common with most mechanical and electrical equipment, excessive maintenance may be readily avoided by keeping careful check on those parts and circuits found by experience to require frequent attention.

Operating time lost due to necessary maintenance may be reduced to a minimum by using slack periods to keep such items as relays, insulators, potentiometers and particularly high voltage circuits free from dust and corrosion; to check and replace batteries or tubes which show signs of low output; to check mechanical vacuum pumps for weak or worn belts, proper oil level and motor lubrication, and diffusion pumps for oil or mercury lev-

TABLE 6—Mass Spectrometer Analysis of Polymerization Streams

Tail Gas		Rich Oil*	
Components	Mole % Present	Components	Vol. % Present
Hydrogen	9.3	Propene	3.0
Hydrogen sulfide	4.1	iso-Butane	2.1
Carbon dioxide	0.4	n Butane	2.2
Methane	44.5	iso-Pentane	1.3
Ethene	9.9	n-Pentane	1.0
Ethane	25.4	Hexenes + Hexanes	0.9
Propane	1.7	Heptane & Heavier	89.5
Propene	3.8		100.0
Butenes	0.2		
iso-Butane	0.4		
n-Butane	0.1		
Pentenes	0.1		
iso-Pentane	0.1		
	100.0		

* Preliminary stripping operation to concentrate the gas fraction.

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els and condenser water supply, and to regrease stopcocks before leakage or breakage occurs.

By adopting a system of routine check during slack periods the spectrometer may be kept in satisfactory operating condition for long periods with little time lost because of unexpected failure.

Procedures for "Difficult" Analyses

Difficult analyses fall into two groups: first, those analyses which are well within the scope of the mass spectrometer but for which operational or computational techniques have not yet been developed and, second, those analyses which, because of instrumental or computational difficulties, are subject to greater than usual error.

Under the first group fall many of the non-hydrocarbon types such as mercaptans, organic sulfides, and disulfides and various oxygenated compounds. For most of these types techniques have been worked out for a few members of each series. However, for any type of analysis it is invariably necessary to prepare a relatively pure sample of the compound to be analyzed and to observe its behavior in the mass spectrometer from the standpoint of adsorption on the walls of the inlet system or absorption in stopcock grease. Thus it must first be established that the pure compound can be put through the instrument without significant loss due to these physical factors. With this established the spectrum of the compound is studied to determine whether or not serious interference is probable with other compounds likely to be present in any mixture containing the compound in question.

The second classification comprises such cases as the analysis of isobutene, butene-1 and butene-2 in a fraction containing considerable concentrations of propene or pentenes and heavier compounds, and the analysis of certain compounds present only in low concentrations. In the case of the C_4 olefins the most satisfactory solution lies in a preliminary fractionation designed to concentrate the C_4 fraction and to free it from interfering substances. The concentrated fraction may then be satisfactorily analyzed for iso and normal butanes as well as the individual butene isomers.

Low concentrations of compounds may frequently be determined with increased accuracy by the simple expedient of increasing the pressure of the sample in the spectrometer inlet system. The normal prerssure of 30-40 microns may be increased to 100 or more microns in many cases without introducing appreciable error and thus the effect of concentrating the original compound by a factor of 3 or more is achieved which results in a corresponding increase in accuracy, particularly where the concentration is initially close to the threshold of detection.

Trouble Shooting

Trouble may broadly be divided into two kinds: First are those troubles which are expected and which recur with more or less regularity, such as tube or battery failure, spectrometer filament failure, leaking vacuum systems etc. These troubles all have well recognized effects and may readily be located and remedied by a sufficiently trained and experienced spectrometer operator.

Second are difficulties which occur infrequently, such as open circuits, electrical leakages, faulty resistors, capacitors, transformers, etc. These require the services of a person sufficiently familiar with electronic equipment to be able to trace circuits and make the proper electrical measurements necessary to locate and remedy the trouble. It is therefore essential for efficient mass spectrometer operation to have available such a person, even though his services will not be required frequently.

To adequately care for emergencies arising from equipment failure it is well to keep on hand a stock of spare parts which experience shows need more or less frequent replacement. Such items are tubes and batteries, spectrometer filaments, vacuum pump belts and oil, fuses, etc. With an adequate stock of spare parts and sufficiently trained personnel on emergency call it will be only rarely that the mass spectrometer will be out of operation for any extended period of time.

Instrument Operating Time

In common with most other analytical methods, the rapidity with which samples can be analyzed by means of the mass spectrometer and consequently the cost of analysis will vary considerably depending upon whether the instrument is used primarily for plant control, where analyses are of the simplest type, or whether a large proportion of complex or unusual samples are involved requiring preliminary stripping or the application of long computational procedures.

In the case of simple mixtures comprising only 3 to 4 components it is possible to analyze approximately 24 samples during an 8-hour shift. Six and one half hours would be devoted to actually running the samples, leaving one and one half hours for necessary calibrations, galvanometer sensitivity checks, battery switching and miscellaneous maintenance. Such operation would require the services of one spectrometer operator and one computer plus approximately half the time of a second computer.

The analysis of more complex mixtures containing from 10 to 20 components would require slightly more instrument time and considerably more computational time. Under these conditions one operator could run approximately 20 samples through the spectrometer while their computation would require the services of from two and one half to three computers.

Before attempting to extend these figures to longer periods of times consideration must be given to operating time lost because of necessary maintenance and repairs, the installation of new ionization chambers and more extensive calibrations than those required for daily operation. A round figure for such lost time is two days per month which has been found to be very nearly independent of the total operating time of the spectrometer. Supervisory time as well as additional technical assistance needed during shutdown periods must be counted and in operations requiring preliminary stripping of the sample prior to spectrometer analysis this time must also be taken into account.

In addition to these labor requirements the determination of total cost of analysis must include such items as power, replacement parts and various supplies such as photographic material and liquid nitrogen. Amortization should also be considered but in view of the lack of definite information on useful

TABLE 7—Breakdown for Four-Week Period of Personnel Requirements for Operation of Mass Spectrometer

Sample type	Gas samples containing 3 to 4 components each A	Complex gas samples containing 10 to 20 components each B	Complex gas samples plus 50% of samples requiring preliminary distillation C*
Number of samples analyzed per four-week period	860	720	720
Operating personnel time (man-hours)	320	320	1280
Computing personnel time (man-hours)	480	720	789
Supervisory personnel time (man-hours)	160	160	320
Maintenance personnel time (man-hours)	16	16	32
Supplies, replacement parts, and power (man-hours)**	150	150	525
Total man-hours	1126	1366	3037
Man-hours per sample	1.31	1.90	4.21

* Personnel requirements for the preliminary distillation are included.
** For convenience this cost item is given in terms of man-hours on the basis of current labor rates.

life and the variety of assumptions which are possible this factor has been omitted. Table 7 shows a breakdown for a four-week period of personnel requirements assuming a 40-hour work week with the instrument operating two shifts per day. For convenience, power, replacement parts and supplies have been converted to corresponding man-hours based on current labor costs.

Three groups of samples are considered: Group A is representative of operation on plant control where the mixtures are gases and are limited to three to four components each. Group B represents more complex gas samples containing from 10 to 20 components each where all components are to be determined. Group C represents a case where approximately 50% of the mixtures analyzed require a preliminary stripping operation before mass spectrometer analysis. It is further assumed that the samples are of a routine type, thereby enabling time-saving computational shortcuts to be fully utilized.

Summary

An attempt has been made to point out the usefulness of the mass spectrometer applied to analytical problems connected with plant control and particularly its wide application to the analysis of many refinery streams when combined with either low or high temperature distillation.

Only a few of the large number of analyses susceptible to mass spectrometer analysis have been illustrated by specific example. However, it should be clear from the basic principles first outlined that few if any gasoline refinery streams cannot be successfully analyzed either directly or with the aid of preliminary distillation procedures.

Figures have been given in terms of man-hours which will aid any laboratory in comparing the cost of mass spectrometer analyses with the cost of whatever method they may be employing.

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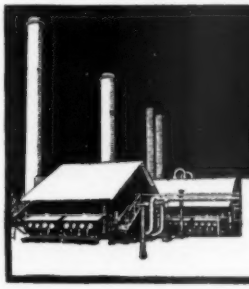

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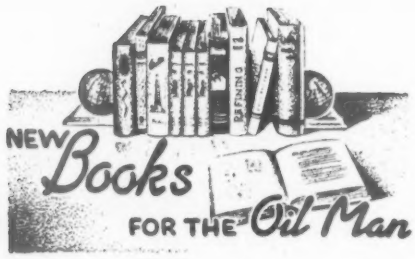

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Knowledge of Principles Of Control is Essential

Principle of Industrial Process Control, by Donald P. Eckman; 5½ x 8¼ in., 237 pages, stiff cloth binding, indexed and illustrated (charts and line drawings only), $3.50.

The increasing importance of automatically controlling industrial processes is reflected in the number of new books on the subject which have appeared in the past year.

One of the latest is *Principles of Industrial Process Control*, by Donald P. Eckman, an engineer with the Brown Instrument Co. The title of Mr. Eckman's book can be taken literally; the text is described as being "primarily devoted to the description and explanation of . . . fundamental principles which apply to the operation of a process when under automatic control as well as to the functioning of a servomechanism and its positioned element."

"An understanding of basic principles," the author states in his opening chapter, "is of great value in the analysis of automatic control problems because these principles may be applied to any problem regardless of variations in physical or mechanical details. The control engineer can then recognize the vital factors and readily sift out the unimportant details. The automatic control problem is thereby reduced to its essential components and further analysis is simplified."

The first chapter is devoted to a discussion of the "Art and Science of Control." Following chapters take up, in sequence, methods of measuring process variables, process characteristics which affect automatic control, theory and quality of automatic control, application of control engineering to processes, and automatic control systems. The final chapter discusses how more exact control can be obtained through proper maintenance of the equipment. Also included is a glossary of 126 terms and definitions.

Although the book is intended primarily for the engineering student, it might also serve as a reference for the industrial user of automatic control equipment.

1945 Edition of "A.S.T.M. Standards" Available

A.S.T.M. Standards on Petroleum Products and Lubricants (1945 edition), American Society for Testing Materials, Committee D-2 on Petroleum Products and Lubricants, 6 x 9 in., 546 pages, paper binding, indexed and illustrated, $2.75.

Latest edition of a familiar occupant of most oil company laboratory shelves, *A.S.T.M. Standards on Petroleum Products and Lubricants*, now is available for distribution. It brings together in convenient form 80 standard methods of test, five emergency standard methods of test, 11 standard specifications, two emergency specifications and three standard definitions. All have been standardized through the work of A.S.T.M.'s Committee D-2 on Petroleum Products and Lubricants.

In addition to the current reports of the committee, there are several appendices covering results of tests to develop a method for estimating maximum pour points of lubricating oils containing pour point depressants, the proposed method, and proposed method of test for total olefinic and aromatic hydrocarbons in gasoline.

The specifications cover gasoline and fuel oils, Stoddard solvent, cut-back and emulsified asphalt (several grades of each), mineral spirits and thermometers.

The format and style of the book follow the pattern used in previous years. However, in the 1945 edition emergency alternate provisions for standard methods and emergency standards form a complete section near the end of the book instead of near the front; as in earlier issues, these are printed on pink paper.

Standard British Methods For Testing Petroleum

Standard Methods for Testing Petroleum and Its Products, 6th edition (1945), 5½ x 8½ in., 575 pages, stiff paper binding, 15 shillings (British currency, about $3.00 U. S. currency), published by Institute of Petroleum, Manson House, 26 Portland Pl., London, W. 1, England.

Standard Methods for Testing Petroleum and its Products, the official publication of the Institute of Petroleum detailing test standards for petroleum in the British Empire, has recently been revised. Patterned closely after the standards published by the American Society for Testing Materials, many of the tests are identical with or modified versions of the corresponding A.S.T.M. standards. Some 35 methods out of a total of 103 carry the corresponding A.S.T.M. designation. Many of the tests are peculiarly British and embrace tests seldom considered in U. S. commercial transactions.

The 575-page volume, paper backed, is divided into four parts: an introductory section which contains a foreword, constitution of the Standardization Committee of the Institute and its various subcommittees and panels, table of contents, numerical list of methods, and formal report of the Standardization Committee; the section containing the methods of test follows; then a specifications section for "petroleum spirit," wartime hydrometers and standard thermometers, and an appendix which includes a boiling point conversion chart, tables for conversion of kinematic to Redwood viscosity, scheme for evaluating crude oil, principles governing oil measurement procedure, conversion tables for petroleum oils (by weight) and an index to the book.

For oil companies contemplating commercial relations with the British, this book is a must; for others it will be an object of more than passing interest. Readers interested in obtaining copies should order directly from the publisher in London.

Case Studies Describe Use Of Plastics in Industry

Plastics in Practice, by John Sasso and M. A. Brown; 7¾ x 10¾ in., 185 pages, stiff cloth binding, indexed and illustrated, $4.00.

Intended primarily for the user or potential user of plastics as a manufacturing raw material, *Plastics in Practice* is a discussion of a series of specific commercial uses of various plastics and methods of fabricating them.

In contrast to the usual texts of plastics, in which the material is generally arranged in sections on each of the plastics and each of the fabricating methods in use, *Plastics in Practice* is a collection of 102 case studies, each typifying the use of a particular plastic or fabricating method. The authors explain this treatment of the subject on the grounds that the reader who is not already familiar with plastics finds himself unable to interpret the information as it is presented in the conventional text. "He finds himself adrift in a sea of information, unable to locate the droplets he needs."

A brief introductory section in the book (10 pages) describes the two main groups of plastics (thermosetting and thermoplastic), various materials under these main groups, methods of forming, comparative properties, important design considerations and cost factors. From that point on the book deals with how plastics, both old and new, have been adapted to specific uses — fog nozzles, name plates, forming dies, industrial face shields and the like.

Authors of the book are John Sasso, managing editor of the magazine "Product Engineering," and Michael B. Brown, Jr., Monsanto Chemical Co.

Processes for Making Nitrile Compounds Patented by Three Oil Companies

By D. P. Thornton, Jr.

Asisstant Editor, NPN Technical Section

At least three large oil companies are readying themselves to make a new line of chemical compounds from petroleum—nitriles or organic cyanides—recent patents indicate. Extensive market surveys have been conducted by one company to determine the volume of possible future industrial demand for these compounds. They are used, among other things, as materials for making plastics and synthetic rubber, in the manufacture of chemicals, and as addition agents for lubricants and fuels.

Present commercial methods for the manufacture of nitriles are said to be cumbersome and high cost, as compared with their production as petrochemicals. New methods patented by the oil companies include catalytic reactions of hydrocarbons obtainable from natural and refinery gases and ammonia, which latter is now being produced by synthesis from natural gas. Claims in a number of patents are reviewed in the article.

INDICATIONS of strong oil-company interest in the chemicals field are apparent in a number of recently issued patents covering synthesis of organic nitrogen compounds—nitriles, amines and amides. Shell Development Co. has been assigned two patents, Phillips Petroleum Co. one and Sinclair Refining Co. five; these cover, respectively nitriles, amines and nitriles, and nitriles, amines and amination catalyst. (See Appendix A).

Amines, nitriles and their derivatives have a variety of present uses in industry, with potentialities of wider use both as addition agents in lubricants and fuels, as intermediate materials for further chemical synthesis and in manufacture of plastics. Methacrylonitrile and acrylonitrile particularly are used in the manufacture of Buna-N oil-resistant rubber. Propionitrile also is an important intermediate in synthetic rubber manufacture.

Amines and their derivatives are useful as anti-knock agents and color stabilizers in motor fuels and as anti-corrosion, anti-sludging, anti-lacquering and color-stabilizing agents in lubricants. Nitriles are useful oiliness agents in lubricants. Diamines and dinitriles are particularly important as a source of raw materials for production of such superpolyamides as "Nylon."

Market surveys for these products indicate several of the major chemical manufacturers alone have more than 1,400,000 lbs per month acrylonitrile capacity, the products selling for prices ranging from 29c per lb. to as low as 19c. Some reports have it that prices below 19c per lb. may be expected in the very near future. On the other side of the picture, a potential market of 250,000,000 lbs. annually of acrylonitrile is seen which, at 19c per lb. means an annual gross income of $47,500,000—$25,000,000 should the price drop to 10c per lb.

Both Phillips and Shell patents point out that present commercial methods involve costly and cumbersome as well as dangerous procedures in the manufacture of organic cyanides. Sinclair's patents comment that cost of production by present commercial methods is "considerable and restricts their use."

Acrylonitrile has been prepared by dehydration of ethylene cyanohydrin, action of hypohalites on the corresponding amine or dehydration of carboxylic acid salts of the corresponding amines in the presence of a dehydrating catalyst such as silica-gel, activated carbon, clays, and the like. Methacrylonitrile has been prepared by the catalytic dehydrohalogenation of alpha-halogenated isobutyronitrile. The avoidance of handling large quantities of dangerous chemicals, such as hydrogen cyanide and acetylene are thus eliminated in the methods described in Shell's, Phillips' and Sinclair's patents.

Acrylonitrile from Natural Gas

Phillips Petroleum has stated it is not producing acrylonitrile commercially at present and plans no plant construction. The patent is indicative of interest in petroleum chemicals, according to a company official, and does not mean product will be produced commercially. Shell, however, is marketing allyl amines and other derivatives, as well as methacrylo- and acrylonitrile.

The Phillips patent is one of particular interest because its hydrocarbon charge stock, methane, ethane or mixtures of the two, is readily available in large quantities from natural gas production as well as a refinery byproduct. The other raw material, ammonia, also is readily available and can be produced by synthesis from natural gas by catalytic processes in prewar use.

First of the two steps disclosed in the patent is the pyrolysis of a mixture of hydrocarbon and ammonia. Preferably the hydrocarbon feed should consist of methane, ethane or a methane-ethane mixture, although any aliphatic hydrocarbon or mixture of compounds containing up to four carbon atoms may be used. The amount of ammonia added may vary over rather wide limits, but the volume ratio of ammonia to hydrocarbon usually is between 1:5 and 1:10. The charge should be substantially free of oxygen.

The pyrolysis operation may, in the language of the patent, occur in small (10 mm) diameter nonporous refractory tubes contained in an electric furnace, or the tubes may be heated by hot gases. Temperature should be at least 1000° C. (1832° F.) and is preferably in the range 1300 to 1500° C. (2372 to 2732° F.) or even higher. Pressure is maintained at sub-atmospheric and preferably below 200 mm of mercury. Vapor contact time should be less than 0.1 sec and is preferably 0.005 sec or even less. Furnace effluent is quickly cooled to within the range 400-500° C. (752-932° F.).

The catalytic second step follows immediately upon cooling the gases from the pyrolysis. No attempt is made to free acetylene and hydrogen cyanide from the contaminating gases—methane, hydrogen, nitrogen—in the pyrolytic effluent. They are deliberately retained, the patent states, because the inert diluents present serve to retard polymerization to such an extent that the ultimate yield of acrylonitrile is much improved. Tests have shown that, because of the very pronounced tendency of hydrogen cyanide, acetylene and acrylonitrile to polymerize, the yield of acrylonitrile obtained from mixtures containing nothing but hydrogen cyanide and acetylene is only about 10% of the theoretical.

Hydrogen cyanide and acetylene in a mol-to-mol proportion and at a temperature of usually 450° C. (842° F.), are compressed from 200 mm pressure required for their formation by pyrolysis to pressures slightly above atmospheric as charge for the final step. There

is no need to preheat them before charging to the catalyst case.

Catalyst is contained in a solid bed of any conventional design. Cyanides of the alkali and alkaline earth metals, particularly sodium cyanide, are preferred as catalysts. These solids may be supported on porous media such as silica gel, alumina and bauxite. Contact time varies over wide limits, according to the patent, depending upon the composition of the pyrolysis effluent stream and upon the catalyst temperature, but generally is in the range 0.5 to 2.0 sec.

Products leaving the catalyst chamber are acrylonitrile, hydrogen, methane, nitrogen and small amounts of unconverted hydrogen cyanide and acetylene. If more than minor amounts of the active reactants, hydrogen cyanide and acetylene, are found in the catalyst chamber tail gas, the proportion of ammonia in the charge to pyrolysis is varied accordingly. Reducing the ammonia ratio increases the proportion of acetylene over hydrogen cyanide and vice versa.

Followed by a water quench from catalyst chamber temperature, the acrylonitrile is recovered by fractional distillation, while light gases are removed overhead from the quencher.

No yield data are reported.

Nitriles from Allyl Amines

The Shell patents also point out the inherent dangers in present procedures for manufacture of acrylonitrile and related compounds, and state that its method overcomes these difficulties and also is a simpler process. It, too, makes use of catalysis.

Unlike the Phillips patent, the Shell method uses unsaturated allyl amines as the starting point of the synthesis, and is based upon catalytic oxidation in the presence of metallic silver or copper, rather than the dual steps of pyrolysis followed by condensation. Yields of 72.5% (mixed nitriles) to 89.4% are reported.

The process is described as particularly adaptable for catalytic oxidation of unsaturated amines containing an olefinic group having two hydrogen atoms on the carbon atom directly attached to the nitrogen atom. However, it may be applied to saturated and unsaturated amines containing the grouping R—CH_2—NH_2, although the process is especially concerned with amines containing the grouping —(C—)=(C—)—CH_2—NH_2 and to the loose bonds of which may be attached hydrogen or various organic radicals which may or may not be further substituted.

Table 1 gives a non-limiting, representative list of unsaturated allyl-type amines which may be catalytically oxidized by the Shell process, followed by a similar list of unsaturated non-vinyl type amines:

It is not necessary, according to the patent, to segregate the various amines for synthesis. Instead, two or more may be mixed before processing.

The process calls for continuous, intermittent or batch vapor-phase reaction at temperatures ranging from 450 to 600° C. (842 to 1112° F.) and preferably from 500 to 525° C. (932 to 977° F.). An equimolecular mixture of the amines and oxygen is diluted with inert gases (steam is preferable, although nitrogen and carbon dioxide may be used) to avoid side reaction, so that concentration of the amine in the charge is less than 50% and preferably within the range 20% to 40% of the total mixture.

The lower limit, 450° C. (842° F.), is sometimes impractical because of the relatively slow rate of reaction. The upper temperature limit is usually determined by the stability and character of the amine and also the resulting nitrile towards cracking, polymerization and further oxidation. Generally, according to the patent, the saturated aliphatic amines permit use of higher temperatures than the corresponding unsaturated compound. Temperatures close to or above 600° C. (112° F.) have been found necessary for the conversion of certain saturated amines to the corresponding nitriles.

When it is desired to operate at high space velocities, it is essential to operate at temperatures which are in the vicinity of the upper limit of the allowable range. When low velocities are employed, it may be found more desirable to operate at temperatures near the low end of the range. Pressure employed usually is atmospheric, although a wide range is permissible; sub-atmospheric pressures are resorted to in the case of some unsatu rated amines which readily polymerize or decompose at reaction temperature indicated for highest yield.

Separation of the nitrile depends in large part on the nature of the diluent used. When steam is employed, the effluent gases are condensed, treated with hydrochloric acid to convert unreacted amine to the corresponding salt and the mixture distilled to recover the nitrile as a constant-boiling mixture with water. This constant-boiling mixture then is redistilled in ternary mixture, or by other common methods, to resolve the azeotrope. The amino salt is treated with caustic soda and distilled to recover amine for recycling to process.

In commenting on the catalyst, the patent states:

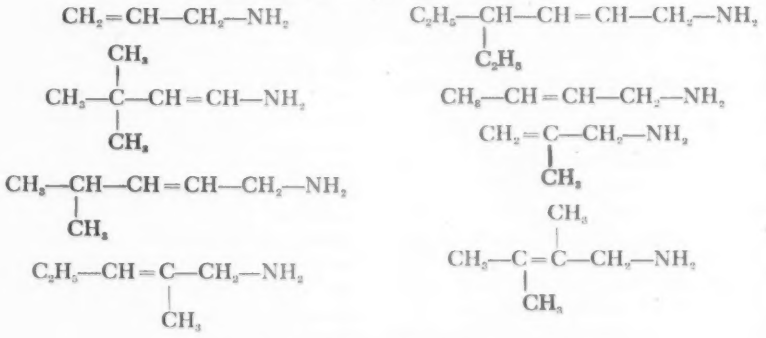
"Suitable catalysts: silver, copper, platinum, gold, cobalt, nickel, vanadium, aluminum, chromium, tin, tungsten, zinc, brass, gold-silver alloy, silver-copper, silver-zinc and silver-arsenic alloys, etc. Oxidizing catalysts containing a metal of the third period of the periodic table, such as titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic and selenium were found to be suitable catalysts for the high-temperature oxidation of unsaturated allyl type amines to the corresponding unsaturated nitriles. Also, it was found that copper and silver metals, and especially the latter, are particularly suitable for effecting the desired reaction. These catalysts are relatively inexpensive, are easily prepared and reactivated and are not readily susceptible to poisoning. Their catalytic activity, which is normally decreased with use, may be restored, for example, by amalgamating the surface and supplying heat to drive off the combined mercury, thus leaving an activated catalytic metal surface."

The Shell patent gives eight examples of preferred procedures as illustrative of their method of catalytic oxidation of amines to nitriles, only one being included here.

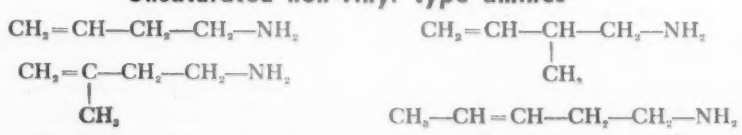
In this example, a 40% aqueous solution of primary methallyl amine was heated to 180-200°C (356-392°F) and mixed with enough air to produce a charge vapor containing one mol amine

TABLE 1—Typical Amines Which Can Be Oxidized Catalytically by the Shell Process

Unsaturated allyl-type amines



Unsaturated non-vinyl type amines



to 0.80 mol oxygen. Charge was passed through a glass reactor maintained at 570°C (1058°F) containing a silver screen catalyst at rate equal to about 0.71 g. methallyl amine and 0.034 cfm of air. During 90 minutes of operation a total of 0.902 mol (about 51.5 g.) of amine was passed over the catalyst.

Reaction product, condensed, was neutralized to methyl red with concentrated hydrochloric acid to convert unreacted amine to a neutral salt, then fractionated. An overhead distillate comprising a constant boiling mixture of water and methacrylonitrile, $CH_2=C-(CH_3)-CN$, boiling between 76.6 and 76.8°C, was obtained. Bottoms were made alkaline to free the amine and redistilled to recover unreacted methallyl amine.

Analysis of reaction product showed 56.3 mol-% conversion of amine to methacrylonitrile, or a per-pass yield of 75.8% based on consumed methallyl amine. Recovered amine amounted to 25.6 mol-% of that originally charged.

Stabilization of Unsaturated Nitriles

Shell's patent covering a method of protecting unsaturated nitriles from autopolymerization during storage involves the use of a small amount of an alpha-beta unsaturated amine or a mixture of several such unsaturated amines. Preferably these compounds should approximate in structure the nitrile to be stabilized.

It is pointed out that acrylo-and methacrylonitriles especially are extensively used in synthetic rubber where the monomer must be employed if a satisfactory product is to result. Many inhibitors presently in use are reported unsatisfactory either because of the large quantity of chemical required or from difficulties incident to inhibitor removal after serving its purpose. Some commonly used inhibitors actually increase rather than retard polymerization of these compounds.

According to the patent, amounts ranging from 0.1 to 2% by weight of the amine, preferably corresponding in structure to the nitrile to be protected, are required for effective inhibition. The amount depends on the degree of instability of the particular nitrile, the period of protection required and the inhibitor used.

Sinclair Amination Processes

The most recent group of patents granted on production of organic nitrogen compounds are five assigned to Sinclair—U. S. Nos. 2,381,470-3 and 709—covering amines and nitriles by direct catalytic reaction of the corresponding olefin hydrocarbons with ammonia and also an amination catalyst of promoted metallic cobalt.

As in the case of Phillips, no plant using the processes disclosed in the patents has yet been built and the raw materials are readily available from petroleum. However, market surveys have been conducted on products of the pro-

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cess, particularly considering acetonitrile, propionitrile and butyronitrile. Acrylonitrile, ethylamine, isopropylamine and *n*-butyl amines are said to be produced economically by the method, possibly as secondary reaction products.

Sinclair's process may operate in any one of three ways: (1) batch type, in which the reactants and catalyst are charged and maintained under high pressure and moderate temperature in a sealed reactor for a given period, (2) as an intermittent process in which the reactants are charged over a fixed-bed of catalyst, which has to be periodically regenerated and (3) as a continuous process in which catalyst is suspended in the olefin charge before it mixes with ammonia in the reaction chamber.

The optimum reaction conditions stated, depending on the hydrocarbon charged, range from 500 to 600°F., pressures of approximately 2000 psi and ammonia-to-olefin ratio ranging from 1.6 to 3.5 mols ammonia to 1.0 mol olefin. Olefins of petroleum origin possessing the double bond at the end of their carbon chains are described as particularly advantageous charging stocks. Side reactions of cracking, polymerization, dehydrogenation and hydrogenation have to be considered in determining optimum reaction conditions.

Concerning selection of optimum conditions aside from those imposed by the olefin charged, the patents state that cracking, which appears to be confined chiefly to the amine produced in the reaction, increases with increasing temperature. Rate becomes rapidly greater at temperatures substantially in excess of 600°F. Cracking rate also is elevated with increasing pressures, particularly above 3000 psi.

Polymerization of the olefinic charge is promoted by high temperatures. It increases with increasing time of contact between reactants and catalyst. Depletion of olefin charge from polymerization is very apparent at temperatures above 600°F.

Dehydrogenation of the amine is not particularly serious in itself, since the amine thus is converted to the corresponding nitrile. However, the hydrogen thus liberated is objectionable because it reacts with the olefin charge to form the relatively inert corresponding paraffin. Investigation indicates dehydrogenation is favored by use of high temperature and appears to attain a maximum in the neighborhood of 1000 psi; substantial reduction in rate of dehydrogenation has been observed at pressures appreciably above this value.

Extent of nitrogen fixation, based on olefin consumed, appears to attain a maximum at 2000 psi. This value is sufficiently above the pressure for maximum rate of dehydrogenation and below that where effects of cracking become objectionable to minimize these undesirable side reactions while permitting maximum nitrogen fixation.

Major equipment items required for Sinclair's fixed-bed intermittent process consist of a pump for mixing reactants, a reactor, cooler and product receiver. Reaction chamber contains a packed preheat zone. A schematic diagram of equipment sequence is shown in Fig. 1, taken from patents No. 2,381,470 and 472. These patents use as an example the amination of dodecene to illustrate the process, the description following is abstracted.

Dodecene-1 was prepared from lauryl alcohol by dehydration over granular alumina, being separated by fractionation from unconverted alcohol.

Dodecene-1 and liquid (or aqueous) ammonia are mixed in pump 1 (Fig. 1), and charged through line 2 into the preheat zone of reaction chamber 3. The preheat zone, comprising upper portion of reaction chamber 3, is electrically heated and filled with stainless steel Raschig rings. The lower portion of the chamber is the catalyst zone, filled with pellets of a catalyst comprising metallic cobalt deposited on diatomaceous silica.

Charge was pumped into reaction chamber 3 for about 1.5 hours, until internal pressure of reaction chamber was approximately 2000 psi. Temperature of charge was maintained at 550°F., and at end of the charging period the chamber contained approximately 1050 cc. dodecene-1 and 425 cc. liquid ammonia.

The reaction product was then released from the lower portion of the catalyst zone through line 4 and valve 5 at a rate sufficient to maintain reaction chamber at 2000 psi. During this time continuous charge rate of 40 cc. liquid ammonia and about 200 cc. dodecene-1 was maintained; this represents a space velocity of about 0.2 through the catalyst bed. Product was passed through cooler 6 and receiver 7 where product was stabilized to remove entrained and dissolved gases. Final product was drawn from receiver 7 at atmospheric pressure.

To obtain analysis of the final liquid product, it was first subjected to fractional distillation to separate three fractions. These are further designated as low-, intermediate- and highboiling fractions, the intermediate fraction consisting essentially of unreacted olefin.

Promoted Catalyst Described

While in all five patents assigned to Sinclair preparation of catalyst is given, one patent, No. 2,381,473, is devoted to preparation and demonstration of effectiveness of an improved catalyst, cobalt-on-silica promoted with manganous oxide. It is claimed this catalyst materially suppresses objectionable side reactions and useful life and uniformity of operation of catalyst is substantially improved. This is of particular advantage, it is claimed, in the amination of propylene using a suspended cobalt catalyst where acetonitrile, *n*-butyronitrile, isobutyronitrile and other organic nitrogen compounds also are produced.

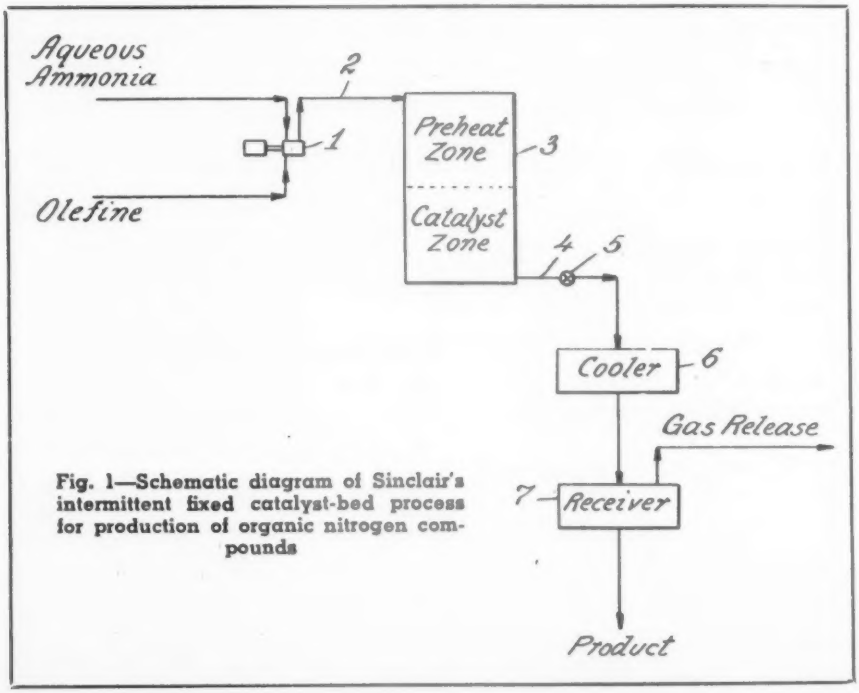


Fig. 1—Schematic diagram of Sinclair's intermittent fixed catalyst-bed process for production of organic nitrogen compounds

Appendix A

List of Nitrile Patents Of 3 Oil Companies

Patents covering the manufacture of nitrile compounds described in the accompanying article are the following:

Phillips Petroleum Co.:
U. S. 2,370,489

Shell Development Co.:
U. S. 2,375,015
U. S. 2,375,016

Sinclair Refining Co.:
U. S. 2,381,470
U. S. 2,381,471
U. S. 2,381,472
U. S. 2,381,473
U. S. 2,381,709

Disposal of Petroleum Refinery Wastes

By W. B. Hart

In Charge of Waste Disposal for Atlantic Refining Co.

Article 3—Refining Industry has Important Role in Water Conservation Program

Conservation is a very general term, but its application to water supply is a dollars-and-cents matter to many refinery operators. The public today is more insistent that plants avoid pollution of surface waters, to safeguard the community's water supply, to insure for other industries water fit for their processing needs, and to maintain the value of the water for agricultural uses.

Of growing importance also, with more people having time for outdoor recreation, is the social nature of the water conservation problem. Refineries and other plants will be called upon to a greater degree to prevent contamination of surface waters used for fishing, hunting and other recreational activities. In some instances also, refinery wastes are a factor in soil conservation, it is brought out in the third article of this series appearing exclusively in the NPN Technical Section.

THE principal natural resources of our country are its soils, waters, forests, grass lands, animals and minerals. For about 400 years after the discovery of America the feeling was prevalent that all these resources were practically inexhaustible, and they were exploited and used with little regard for their replacement or conservation.

As the country grew and developed, so did the exploitation and use of its resources, until today there is evidence all around of the effect of the disregard for conservation, and of the constant battle with the elements which frequently has resulted. The human misery and costliness of the so-called "dust bowl" region, and the toll of lives and property claimed by floods which rush down from areas denuded of forest or other vegetable cover, carrying with them silt and debris that chokes the natural drainage paths, are outstanding examples of the prodigality of past years.

The erosion of beaches and shore lines, and the losses of valuable materials in forest fires also should be included. To prevent these results of this "live today and let tomorrow take care of itself" attitude, there is now a clamor for soil conservation, flood control and other man-made installations to act as barriers against the elements.

Elements Follow Natural Laws

These elements operate according to natural laws from which there is no appeal. When the laws are broken, disastrous consequences ensue. These consequences have been predicted by the same type of scientific minds, working on these particular problems, as the minds which gave us the geophysical methods for subsurface geology, the modern cracking processes, and the atom bomb. Usually, however, the predictions of disaster were unheeded, and the inroads of the elements had to be countered by costly installations which, although self-supporting in some instances, in many others must be included in any estimate of the cost of the damage already done. Even today there is no well correlated conservation plan in the country. One was started, but it fell victim to politics. It had a great many faults, but at least it was a start.

Where the pinch of failing resources has been felt, however, plans for conservation have been laid and some are being practiced successfully. Most people connected with the petroleum industry are familiar with the work of the Oil States Compact, and the procedures and plans to conserve natural gas. The American Wildlife Institute[19] and Ducks Unlimited[20] are among the largest of the wildlife conservation groups recently organized. Each group is sponsored and supported by many outstanding men of industry. There are many others, such as the American Fisheries Society[21] which is active in fisheries conservation as well as other matters of this nature.

Some Deride Conservation

Some people deride any thought of conservation because they do not know what it means and are unwilling to try to learn. Often, as is the case with waste disposal policies, it appears they have the idea that, if they know nothing about it, they will not have to bother to do anything about it. Others seem to be afraid to find out, for fear they will have to do something about it. The realistic effect is that relatively little overall conservation is practiced.

Conservation implies wise use, avoidance of waste and, wherever possible, restoration and perpetuation. Conservation in no sense implies hoarding or denial of use. Today it is well known that much of the country's natural wealth is gone. Some has been used wisely and some wasted. But much is left and, if used wisely and replaced where that is possible, the remaining natural resources will serve for centuries to come. Conservation is an economic and social problem, not an academic or sentimental one. It has been the subject of prolonged discussion and controversy. If it were as simple to solve the problem of conservation by conversation as it is to rearrange the spelling of the word, there would be no problem.

The relationship of the petroleum refining industry to the conservation of natural resources is confined largely to water, but to some extent to soil, although to the latter in a secondary manner. The principal uses of water are for domestic water supply, industrial water supply, irrigation and stock supply, fisheries, power supply, and recreational purposes. The order of importance in this listing will vary in different localities.

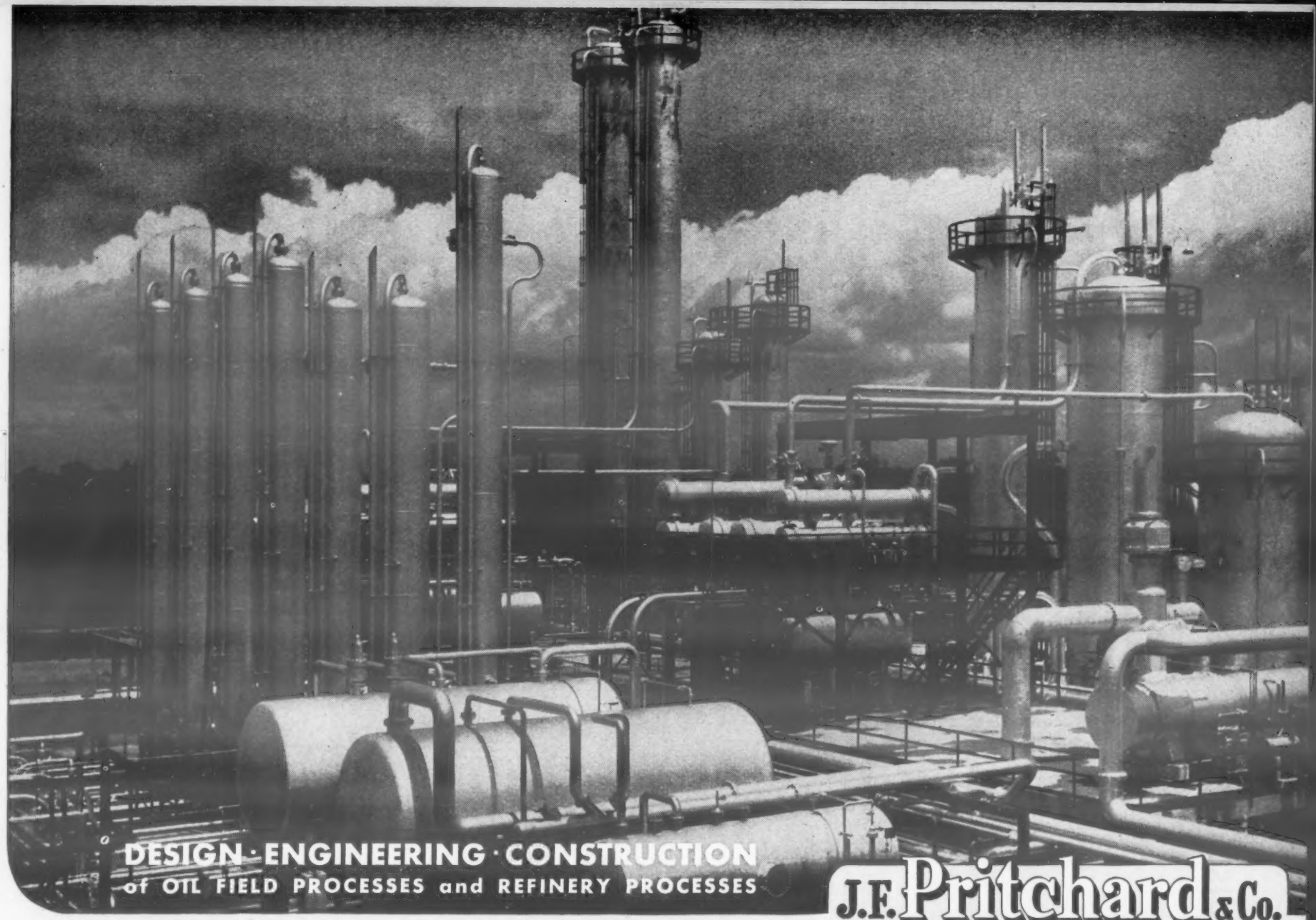
Domestic Water Supply Has Priority

The use of water for domestic supply, since it includes water for human consumption, takes precedence over any other use or abuse of water. This principle has been sustained by many decisions in various courts of all levels. The importance which is attached to this use of water may be appreciated from the cost of the supply systems of several large cities. New York brings water from lakes and rivers up to 150 miles away, San Francisco from 170 miles and Los Angeles from the Colorado River, 270 miles away. These cities, having no usable fresh water close by, have had to spend many millions to obtain it.

Many smaller cities and towns take their supplies from streams and lakes at their doors, and often these supplies are affected by waste waters from refineries. Such supplies are just as important to the communities they serve, from the standpoint of health and general domestic purposes, as those which cost millions of dollars are to the populations of cities which obtain supplies from distances. If the water supply is harmed by refinery wastes to a degree which cannot be corrected by treatment to obtain a water of good purity and taste, water conservation has not been practiced, for the stream or lake, as a resource, has been destroyed. Further, if a safe supply can be produced by treatment, but one which has a disagreeable taste, the taste may cause people to go to springs or other sources in the vicinity which, though they taste better, are not safe. Then, epidemics of water-borne disease

COST-CONSCIOUS?

Then turn to PRITCHARD



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may follow. Thus the refinery may be closely related to conservation.

Water in large quantities is used in industry, and not a few industries require water of high purity. Few, if any natural surface waters will provide constantly the degree of purity desired, and the industry needing high purity must provide its own treatment. But if the water supply is polluted to a degree which makes treatment impossible or prohibitive in cost, the establishment must be moved because the water resources of the locality have been destroyed. Water supply is so important to some kinds of industry that it is a deciding factor in selecting the site for the plant. Refinery waste disposal can impair seriously surface water quality which is important in the industrial development of a community and thus to the inhabitants of the community.

Arid Regions Appreciate Conservation

The greatest appreciation of water will be found among the people who live in regions where water is scarce. In such places conservation is practiced without urge to do so. Refineries in such regions spend thousands for water cooling towers; houses are supplied with catchments to retain rainfall; and windmills advertise the use of subsurface waters pumped from wells. But ground water supplies often fail so that, when irrigation lines and canals bring water to such places, they often are changed from poor producing regions to prosperous farming or ranching areas.

This is true wherever the rainfall is less than about 20 ins. per year, and in the western part of the country it is estimated that 50,000,000 acres of good rich soil need only water to become highly productive[22]. Much of the water supplied through irrigation systems finds its way into beef, dairy products, citrus fruits and vegetables, all industries which run into millions of dollars annually. Thus, irrigation is one of the most important of our water uses, and adds immeasurably to the value of water as a natural resource.

Water for irrigation is taken from many sources, even from relatively small streams. Refinery wastes can destroy the value of water for irrigation and as a supply for stock raising. Toxicity, taste and odor, dissolved solids, all can be seriously harmful. If the communities served by the water into which the refinery discharges its wastes are to remain prosperous, the cleanliness of the water must be conserved, i. e., the refinery must practice conservation.

The question often has been asked, "Why spend thousands of dollars to treat wastes just to save a few fish?" This question itself is evidence of a grave lack of knowledge of the matter. The inland fisheries of the country assumed new and high importance during the war as a contributor to the nation's food supply, and fish ponds have appeared on thousands of farms. This source of food (which often included even the so-called rough fish), and of recreation, will not likely be given up entirely after the war.

Tons of Fish Involved

But it is not just a few fish which are involved. The Great Lakes yield about 100 million pounds of fish per year, of which Lake Erie produces about 30 millions of pounds[23]. The Tennessee Valley, Mississippi River, Missouri River, and the fisheries of many other streams, contribute other millions of pounds. The hatchery stations over the country during 1943 distributed nearly 7 billions of eggs and fingerlings to the various states and foreign countries, and over 30 millions of fingerlings to various federal agencies[24]. A survey by "Outdoor Life" indicates that 26 millions of people will be hunting and fishing annually in the post-war years, and that these sporting activities mean a business of over 4 billions of dollars each year[25]. If even half of this business is realized it will be a big volume.

It is obvious that the refineries of the country, scattered as they are, cannot have a great detrimental influence on the fishing and hunting activities over the entire country. But where there are centers of refinery activity and where even relatively small refineries are located on small streams, serious damage can be done by untreated waste waters which are toxic, or excessively acid or alkaline, or which contain suspended matter or sludges which will settle on the stream or lake bottoms. The aggregate of these conditions over the entire country can be very serious, and will not be looked upon kindly by people who have more leisure hours each year for fishing and hunting. Here again is more evidence of the value of our surface waters as a natural resource, and of the relation of the refining industry to conservation.

Navigation, as a use of water, will be affected but little by refinery wastes from the standpoint of natural resources. This will be discussed further when the effects of wastes are considered.

The recreational values of surface waters are regarded by some people as worthy of little consideration. But these recreational values constitute one of the most important factors of the social problems of water conservation. It is difficult to evaluate the recreational values of surface waters. By comparison and inference, however, some idea of their value can be had from the statement that for tax purposes the New Jersey coast line, a strip one and a half miles wide, is reported to be valued at a figure higher than for all the agricultural lands of the state. Other shore areas, and many recreational areas over the country must have comparable values as related to their location and the density of population surrounding them. Needless to say, such values place recreational uses in the economic as well as the social problems of conservation.

Waste Disposal Affects Erosion

Finally, there is a relationship between the refinery and soil conservation. Untreated refinery wastes of certain kinds will kill all forms of life, both animal and vegetable, that has its being in or near surface waters. When the bank and shoal vegetation is destroyed, erosion sets in. Banks are undermined and collapse; indentations develop and grow. Eventually such soil erosion can spread over wide areas, and the washed soil is deposited in the stream, choking the drainage path. Floods follow and the damage spreads.

Instances of soil erosion of this kind are not uncommon. Conservation will correct the condition and prevent the soil erosion. Thus, the refining industry is related to both water and soil conservation. Conservation means treatment of the refinery waste water to the necessary degree. But before this can be done it must be known what wastes are produced. This will be discussed in our next article.

April Article

Turning to the practical aspects of the subject, the types of wastes that petroleum refineries have to dispose of are discussed in the fourth article in this series, to appear in the April 3d issue of the NPN Technical Section. This will be followed by a discussion of the effects of these wastes on surface water. This is a preliminary to a presentation in the series of practical methods for disposing of wastes to avoid contamination of surface waters.

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Use of Chemical Additives In Petroleum Products

By L. A. Hamilton and P. V. Keyser, Jr.
Research and Development Laboratories, Socony-Vacuum Oil Co., Inc.

An all-inclusive review of the development of addition agents for fuels and lubricants. While many articles have appeared discussing individual types of additives for specific purposes, these refining technologists have studied the subject as an entity. Fuel additives are classified by their functions, also lubricants additives, and the types of materials in commercial use are described briefly.

The patent literature on the subject is reviewed, particularly the technical literature on lubricants additives. Some work has been done on fundamental investigations of the functions performed by chemical addition agents in controlling oxidation and bearing corrosion reactions in lubricating oils and more research work in the future will be of this character.

In the field of fuel additives increasing need is seen for combustion assistants for fuel oils, and for improvement in the detergent type additives for motor oils if they are to be used successfully in aviation oils.

WHILE it is probable that most chemists are in some degree acquainted with the use of chemical additives in petroleum products, it may be well to define these materials and outline the reason for their use.

A chemical additive is a chemical compound not normally present in the refined petroleum product and which has the ability to change the physical or chemical properties of the product. Many properties have been established as desirable in petroleum fuels and lubricants. Some can be attained by suitable refining methods. Refining, however, is generally subtractive. In the case of lubricating oils, it is purely subtractive. Chemical addition agents are used to obtain results not attainable through refining methods and to partially replace refining methods when desired properties can be obtained more cheaply by addition of such an agent than by refining.

While large-scale commercial use of lubricant additives in petroleum dates only from about 1930, some of the basic ideas on which such use is based are quite old. They can be well illustrated by three old patents. British Patent 2668, issued in 1855 to Hyde, states that the addition of even a very minute portion of rubber instead of fatty oil to a hydrocarbon oil would improve the lubricating or oily character of the oil. It also points out that amounts greater than about 1% are detrimental, whereas about 0.5% will give durability and lubrication much beyond that of sperm oil.

U. S. Patent 66573, issued July 9, 1867, to Eames and Seeley, states "our invention is mainly founded on the fact which we have demonstrated by repeated and careful experiments, that a small quantity of caoutchouc or India rubber dissolved in any of the ordinary oils increases their fluidity at low temperatures, while at the usual summer heat, the adhesiveness of the body of the oil is increased."

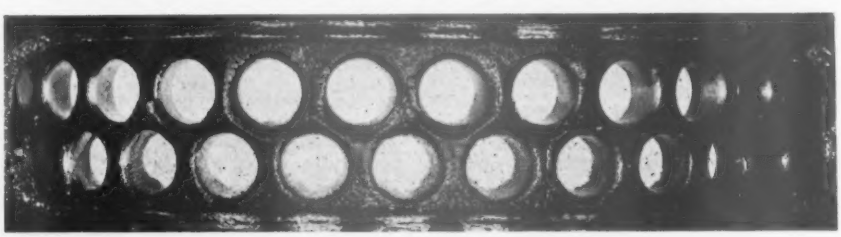
British Patent 1516, issued to Baird in 1872, states: "In treating lubricating oils according to this invention a quantity of mineral oil and sulphur, in the proportion of from 2 to 5 parts of sulphur to 100 parts of oil, are placed in an open pan or vessel which is then subjected to heat, the temperature of the oil and sulfur being slowly raised to from 270 to 290° F., and maintained at such temperature until the sulphur is liquefied and combines with the oil.

"The oil, still heated, is then mixed with one or more suitable animal or vegetable oils, such as lard, tallow, olive or rape oils, lard being by preference employed and in such proportions as to give the oil when mixed therewith a specific gravity of from 900 to 910 of Twaddle's hydrometer, or thereby according to the class of machinery for which the oil is intended to be employed as a lubricant.

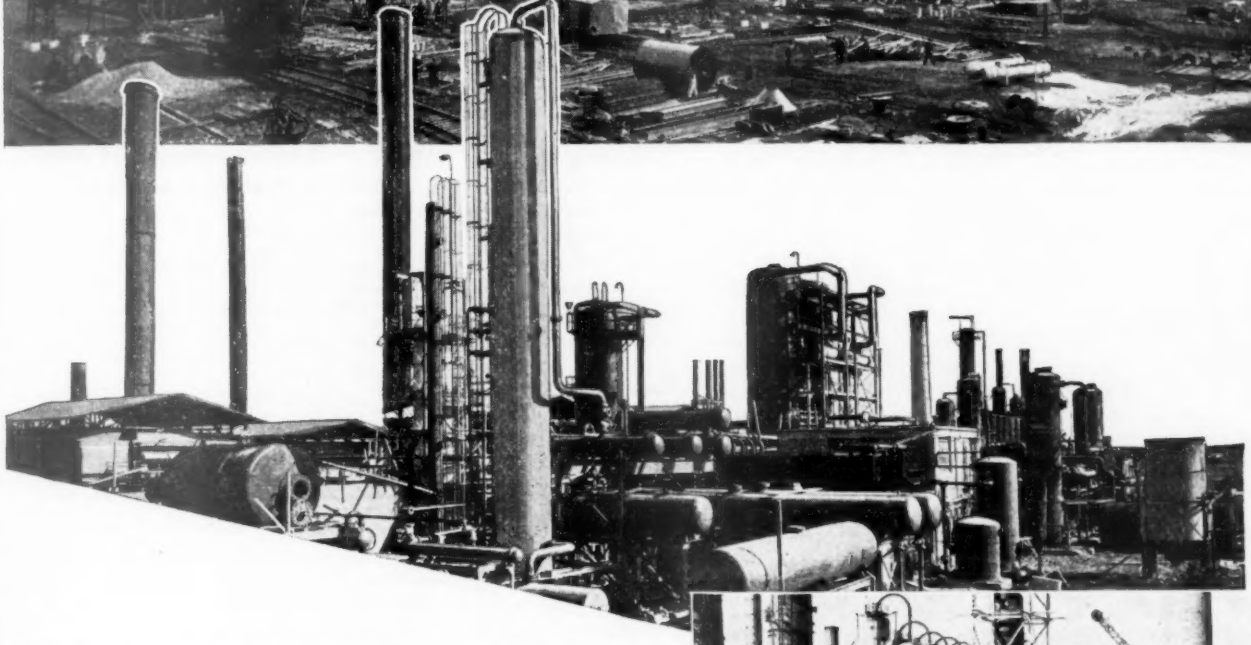
"The effect of this invention is to render naturally oxidizable oil non-oxidizable. In the case of lubricating oils the non-volatile, that is, the non-drying oils as hitherto prepared for this purpose, are soon decomposed and become rancid on exposure to the temperature. When such oils are sulfurized according to this invention the sulfur prevents the oils from absorbing oxygen and becoming decomposed, and in the case of such oils as are employed in spinning wool and other similar material or in spinning jute or other similar fibrous substances, the combination of sulfur with the oil tends to render such oils less liable to burn spontaneously."

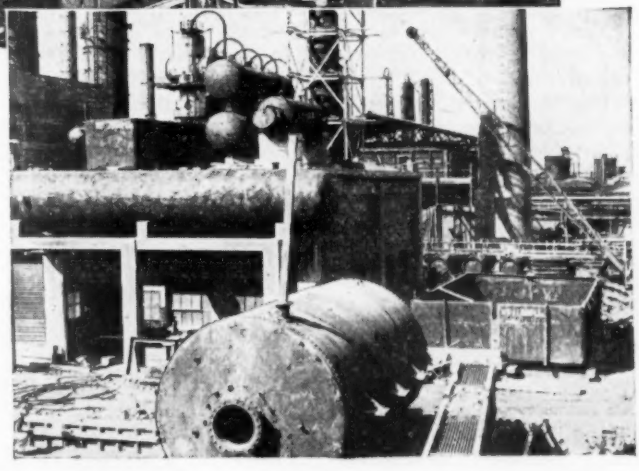
Modern development of the use of chemical additives in petroleum products closely follows the development of the automotive engine and of the petroleum industry's need to supply suitable fuels and lubricants for its operation. Prior to about 1925 no additives as such were used in petroleum fuels

Ports from a 500-Hr. G.M. Diesel engine test: Upper, after 122 hours with an uninhibited base oil; lower, after 500 hours with an inhibited detergent oil



3 DIFFERENT JOBS WITH A COMMON ANCESTRY





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or lubricants. From 1925 on there has been a progressive development of the use of these chemical additives and this development continued at an accelerating rate until 1940. The discussion of additives can best be divided first into additives for fuels and additives for lubricants and then sub-divided according to the type and functional uses of the additives.

Additives used in fuels may be divided into:

(1) Gum Inhibitors or Oxidation stabilizers.
(2) Combustion Assistants.
  (a) Anti-knock Agents.
  (b) Cetane Number Improvers.
  (c) Combustion Assistants for Burner Fuels.
(3) Catalyst Deactivators.

The use of anti-oxidants to prevent gum formation in gasolines followed the development of cracking processes which in turn were necessitated by the efforts of the oil industry to prepare more gasoline from a given amount of crude so that increasing automotive demands for gasoline could be met. Straight-run gasolines contain only low concentrations of unsaturates and no diolefines and are relatively stable. Cracked products proved to be quite unstable due to their high content of unsaturates, including diolefines, and, in the period between 1920 to 1930, it became increasingly necessary to prevent gum formation through the use of chemical additives.

The development of anti-knock agents is a known chapter and will not be discussed here.

During the past 10 years cetane number improvers for high speed diesel engine fuel have been extensively studied and a great many patents have issued covering compounds for this use. However, as yet, there has been no extensive commercial use of such agents. Amyl nitrate, and the lower alkyl trisulfides are among the more effective materials reported to date. 2, 2-dinitro propane has recently been announced as a cetane number improver. This compound is both effective and remarkably stable in the fuel under long time storage conditions.

Combustion assistants for burner fuels likewise have not yet been put into commercial use. However, extensive studies are now being made in several laboratories of a number of such agents. These assistants serve to greatly reduce smoke and combustion residue from certain types of fuels and their use may become necessary if lower grades of fuel are used in pot type burners. The combustion assistants proposed have all been organic compounds of catalytic metals such as cobalt, chromium, and nickel.

These combustion assistants loom large on the horizon of additive potentialities. Refining techniques designed for gasoline production are by no means optimum for the manufacture of fuels for continuous applications. Such fuels, now by-products of gasoline manufacture, are changing in hydrocarbon composition to lower paraffin, higher aromatic concentration with accompanying decrease in H/C ratio and cetane number. Refining corrections such as solvent extraction are expensive and reduce volume. Here the problem is today largely one of producing combustion assistants at a reasonable price.

Recent work in the gas turbine field which cannot be discussed in detail because it is classified information, clearly indicates a wide possible application for such additives.

The use of the copper sweetening process resulted in unstable gasolines due to the presence of up to 10 parts per million of solube copper which was retained in the gasoline. To meet this problem organic compounds called copper deactivators were developed which combine with and eliminate the catalytic activity of soluble copper in gasoline. The principal commercial agent of this type is di-salicylal propylene diamine.

A total of over 400 patents have issued claiming various additives for fuels. The principal commercial additives in use today are shown in Table 1.

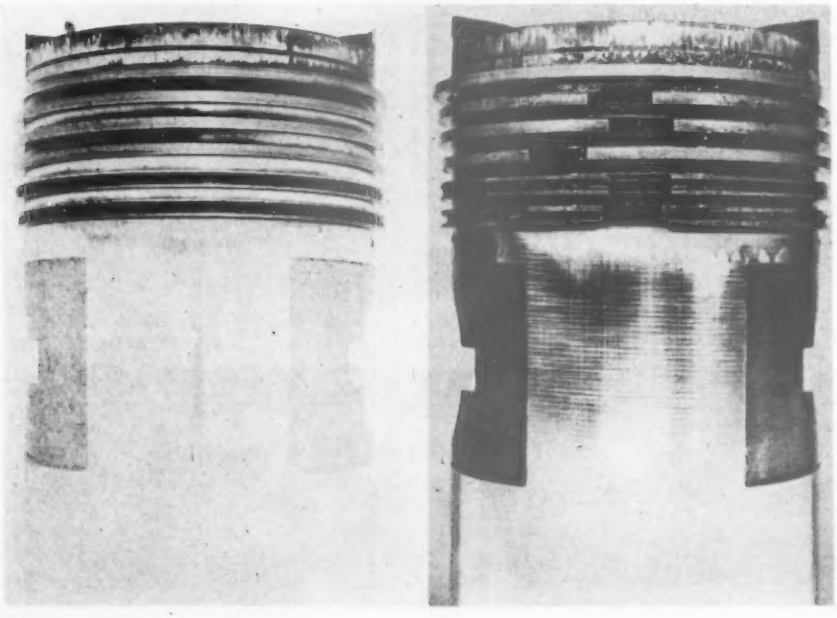
TABLE 1—Principal Commercial Additives for Fuels in Use Today

Anti-Oxidants
- n-butyl-aminophenol
- iso-butyl aminophenol
- di-secondary-butyl-p-phenylene diamine
- alpha naphthol
- phenol fractions from wood tar
- cresols
- alkylated cresols

Anti-Knock Agents
- tetra-ethyl-lead with accompanying halogen compounds to combine with lead

Copper Deactivators
- di-salicyclal propylene diamine
- salicylal-o-amine phenol

Pistons from 96 Hr. single-cylinder Caterpillar engine test: Left, with an inhibited detergent oil; right with uninhibited oil



Lubricants

Several types of additives have been developed for use in lubricating oils. These may be broadly described as:

- Pour Point Depressants.
- Viscosity Index Modifiers.
- Stabilizers (Oxidation Inhibitors).
  - Turbine Oil Stabilizers.
  - Motor Oil Stabilizers and Bearing Corrosion Inhibitors.
- Motor Oil Detergents.
- Extreme Pressure Lubricant Assistants.
- Lubricity or Oiliness Agents.
- Rust Inhibitors.
- Anti-Foam Agents.

Such a classification appears rather simple but is complicated in practice by the fact that many additives are polyfunctional and fall under several of these groups, rather than in a single group. The subject is further complicated by the variable nature of lubricating stocks and by the great range of service conditions encountered. Each of these groups will be discussed briefly before passing to a discussion of their use in lubricating oils.

Pour Point Depressants

When an oil containing dissolved paraffin wax is cooled below its saturation temperature the wax crystallizes. Under normal conditions the wax will separate in the form of large interlacing crystals which prevent liquid flow. Under a standard set of conditions the temperature at which liquid flow ceases is reproducible and characteristic for a given

oil and is known as the pour point. Pour point depressants, as the name implies serve to lower the pour point of an oil. They appear to function by directing crystallization of wax into microcrystalline particles and by preventing development of a solid crystalline structure which entraps and immobilizes the liquid portion of the oil.

Many effective materials are disclosed in the patent literature[1-2], of which two are in commercial use. These are (1) Paraflow, which is a condensation product of chlorinated wax and naphthalene and (2) Santopour which is a condensation product of chlorinated wax and phenol followed by further condensation of this reaction product with organic acids.

In recent years the pour depressant problem has been complicated by the so-called reversion problem. Depressed oils have set up under fluctuating temperature storage conditions at or near their ASTM pour point and actually failed to pour at temperatures as much as 30° F. above their pour point. Several new additives are appearing which tend to prevent this reversion.

Viscosity Improving Agents

These types of additives are high molecular weight polymers which are used in relatively high concentration, usually 5% or more, and which serve to lessen the change in the viscosity of an oil with change in temperature. The viscosity of an oil is also increased by inclusion of such an agent. Many products are listed in the patent literature [1-2] of which two commercial types of V. I. Improvers now are in use. These are the Paratones, high molecular weight polymers of isobutylene and the Acryloids, which are reported to be polymers of methacrylic esters[3].

Stabilizers (Oxidation Inhibitors)

Several classes of stabilizers have been developed for use in lubricants. The type used in each case is selected to suit the type of base stock and the service conditions to be encountered. Two major divisions of these stabilizers may be made, (1) turbine oil inhibitors and (2) motor oil stabilizers and bearing corrosion inhibitors.

Turbine oil inhibitors are used in highly refined stocks where low temperature service conditions are anticipated. These inhibited stocks display the induction period characteristics of an inhibited chain reaction. A great many compounds, especially of the aromatic amine and hydroxy types have been disclosed in the patent literature for this type of service [1, 2, 9]. Commercial use has been made of beta naphthol, phenyl beta- and phenyl alpha-naphthylamines and Paranox 441—a tertiary butylated-p-cresol, probably 2, 6-di-tertiary-butyl-4-methyl phenol.

Motor oil stabilizers and bearing cor-

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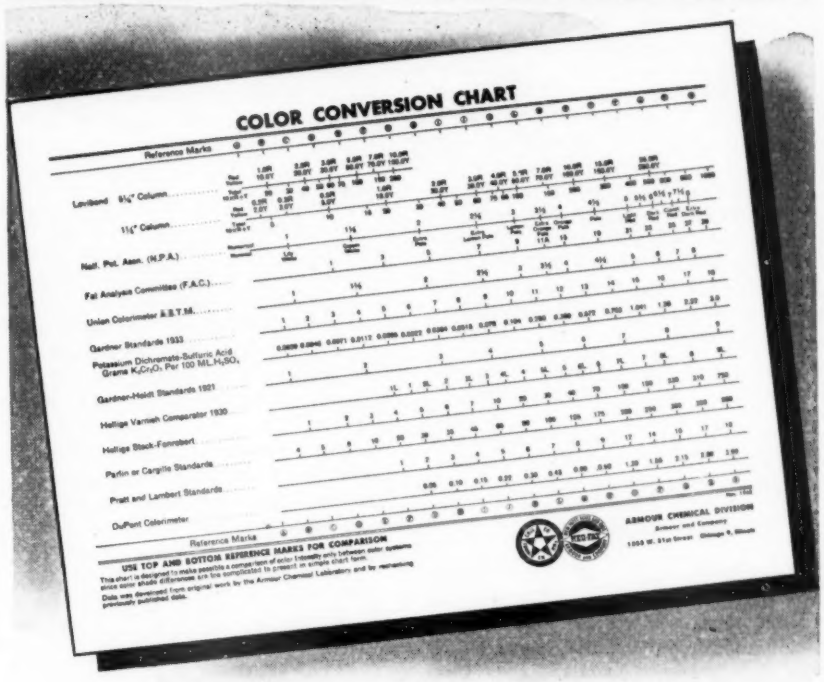

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rosion inhibitors include all those classes of materials which appear to prevent deterioration of oil and corrosion of bearings in combustion engine operation. The mechanism whereby these agents function is not clear and it is probable that several different mechanisms may be involved. There is evidence to indicate that apparent motor oil stabilization may be attained by inhibition of chain oxidation, by deactivation of soluble metal catalysts, by deactivation of catalytic solid metal surfaces, by protection of metals from corrosion by absorbed or combined organic layers, and by selective or directive oxidation of secondary oxidation products resulting in less sludge formation.

A large number of agents have been disclosed as motor oil stabilizers [2]. Many of these materials are complex reaction products rather than single chemicals. The types used in commercial oils are given in Table 2.

Motor Oil Detergents

A detergent motor oil is one which keeps an engine clean. The first oils of this type were diesel engine oils containing calcium naphthenate, and because it was at first believed that these oils washed the dirt out of an engine they were called detergent oils. In actuality this term is a misnomer, since commercial detergent additives do not possess detergent properties to any appreciable extent. Detergent additives are generally directive oxidation catalysts. They promote oxidation and bearing corrosion, but at the same time they lessen sludge and carbon formation in oils. They also have, to a marked degree, the property of maintaining any sludge and carbon which do form in a colloidal dispersion in the oil.

In engines using alloy bearings it is necessary to counter the pro-oxidant effect of detergents with motor oil stabilizers and corrosion inhibitors. It seems probable that some detergent additives act to further oxidize normal oil oxidation products and to convert them to products which will not form oil-insoluble sludge.

In so far as is known all commercial detergent additives are metallic salts of high molecular weight organic acids or phenols. Calcium and barium salts have predominated although potassium, nickel, cobalt and zinc have been used. The organic acids used to make these salts are largely of the following general types:

Highly alkylated phenol sulfides.
Petroleum sulfonic acids.
Highly alkylated benzene sulfonic acids.
Olefine—P_2S_5 reaction products—partially hydrolyzed.
Di-substituted di-thio-phosphoric acids.

Extreme Pressure Assistants and Lubricity or Oiliness Agents

These are agents which impart to oil higher lubricating qualities than may be attained with oil alone. In general, agents which permit operation under high load, high temperature conditions are considered to be extreme pressure lubricant assistants. They are mostly sulfur, chlorine and phosphorus compounds and are believed to prevent welding of metal surfaces by forming an inorganic sulfide, chloride or phosphide film.

Agents which lower sliding friction are usually called oiliness or lubricity agents. They are generally long chain polar compounds and are believed to function by forming an adsorbed or combined oriented film on a metal surface which in effect presents a hydrocarbon rather than metal surface, entirely eliminating metal to metal contact.

In practice, compounds having both properties, or a mixture of several types of compounds, are used.

The compounds or reaction products shown in Table 3 have been used to improve the lubricating properties of commercial oils and extreme pressure lubricants. Many additional types may be found in the patent literature[1,2].

Rust Inhibitors

For turbine service, very small amounts of long chain substituted poly-carboxylic acids or of long chain substituted hydroxy polycarboxylic acids and esters are believed to be the agents used.

Anti-Foam Agent

Dow Corning Fluid (No. 200), a silicone, is the only agent known to be in use for this purpose.

High quality lubricants are combinations of suitable base oils with suitable additives but the development of high quality lubricants involves a great deal more than the blending of a suitable base stock with a number of chemical additives. Each type of petroleum lubricant must meet an extensive list of specifications, ranging from physical tests to full-scale engine tests.

It does not now seem desirable to attempt to outline the many laboratory and engine tests used to evaluate these various oils. Nearly all such tests are described in detail in ASTM procedures or in Army-Navy specifications. The testing of any new product is long and expensive and the final decision as to practical use still rests largely on extensive field tests.

However, it may be stated that to date, using these methods, the oil industry has been able to develop products to meet all lubricant and fuel needs as they arise.

A generalized breakdown of a number of the more important types of petroleum oils and the classes of chemical addition agents which are believed to have been used in them at one time or another is given in Table 4.

Crankcase oils for combustion engines fall into 4 main groups—automotive, diesel, all-purpose heavy duty, and aero engine oils. These are all subjected to high temperature service conditions. Prewar automotive lubricants and most civilian oils during the war contained a pour depressant and an additive such as a phosphite which improved

TABLE 2—Commercial Types of Motor Oil Stabilizers

Tri-butyl-phosphite
Tri-phenyl-phosphite
Tri-p-tertiary amyl phenyl phosphite
Alkyl phenol sulfides
Sulfurized fatty oils
Sulfurized terpenes
Reaction products of phosphorus sulfides with olefines and with fatty oils
Other fatty products containing phosphorus and sulfur

TABLE 3—Compounds Used to Improve the Lubricating Properties of Oils and Extreme Pressure Lubricants

Aromatic chlorine compounds
Stabilized chlorinated paraffins
Dibenzyl disulfide
Chlorinated paraffin reacted with an NaSR compound
Sulfurized fatty oils
Sulfurized terpenes
Fatty oil—P_2S_5 reaction products
Olefine—P_2S_5 reaction products
Lead soaps and sulfur compounds
Alkyl acid phosphate
Tri-cresyl phosphate
Tri-p-tertiary amyl phenyl phosphite
Fatty oils
Fatty acids
High sulfur lubricating oil
High molecular weight ketones and esters

TABLE 4—Types of Additives Believed to Have Been Used in Various Commercial Oils at Various Times

	Combustion Engine Oils						
Type of Additive	Automotive	Diesel	All Purpose Heavy Duty	Aero	Extreme Pressure Lubes	Hydraulic Fluids	Turbine Oils
Pour Depressant	X	X	X	X	X		
V. I. Agent	X	X	X			X	
Turbine Oil Stabilizers						X	X
Motor Oil Stabilizers & Bearing Corrosion Inhibitors	X	X	X	X	X		
Detergent	X	X	X	X			
Oiliness or E. P. Agent	X	X	X	X	X	X	
Rust Inhibitor					X	X	X
Anti-foam Agent	X	X	X	X	X	X	

oxidation stability and bearing corrosion and gave some improvement in lubricating properties.

Prewar diesel lubricants generally contained a pour depressant and a detergent and in some cases also contained oxidation inhibitors, corrosion inhibitors and E. P. agents.

All-purpose heavy duty oils are suitable for both automotive and diesel service. Only one or two such products were introduced to the trade prior to the war. However, early in the war this type of oil was adopted by the Army and Navy for use in all high speed combustion engines—except for aero engines—and detailed specifications were established.

In general, such an oil may be expected to contain a pour point depressant, a detergent, an oxidation and bearing corrosion inhibitor, anti-foam agent, and sometimes a lubricity agent and an anti-rust agent.

V. I. improvers may be used in any of the above oils to upgrade a low V. I. base stock to the proper level.

Aero engine oils have generally been free from all additives except for pour point depressants although at one time a small amount of tri-cresyl phosphate was used as a wear reducing agent in a commercial oil. Recent experimental work, however, has indicated that a detergent-anti-oxidant combination may greatly improve these oils provided the concentration of metal and its resultant effect on combustion chamber deposits is a minimum.

Turbine oils, in contrast to combustion engine crankcase oils, are subjected to low temperatures and relatively mild oxidation conditions. Prior to 1937 only one turbine oil was known to be inhibited (beta naphthol) and field service life ranged from 1 to 30 years depending upon the turbine installation. At the present time inhibited turbine oils are available which have extended service life particularly in installations where severity is high. In uninhibited oils the oxidation products of the oil protect a turbine from rust. The inhibited oils are so stable, they do not form oxidation products to provide rust protection, and it is desirable to include a rust inhibitor.

Extreme pressure lubricants have been developed principally to meet the severe operating conditions encountered in the hypoid gear. When this type of drive was introduced by the Packard Motor Car Co. in the 1920's it was necessary to introduce new types of lubricants to permit operation under the high load conditions encountered. The first such products used were lead soap-active sulfur compounds which permitted operation but sludged badly and had a very short service life. Extensive investigation in this field led to the development of chemicals containing both sulfur and chlorine, or sulfur, chlorine and phosphorus, which gave satisfactory service. Present E. P. lubricants generally contain additives with extreme pressure properties in the sulfur, chlorine, phosphorus group, a fatty oil or long chain polar compound, an oxidation stabilizer, and in some cases, may contain an anti-foam agent, a pour depressant or a rust inhibitor.

Hydraulic fluids are specialty products requiring an extremely low pour point, and extremely high viscosity index, good oxidation stability, good lubricating power and in some cases, protection against rusting. In these oils pour characteristics are generally obtained by selecting a proper base stock and V. I. improvers, oxidation inhibitors, E. P. agents, anti-foam agents, and in some cases, rust inhibitors are added.

The literature on chemical additives in petroleum consists of two major groups, a very extensive patent litera-

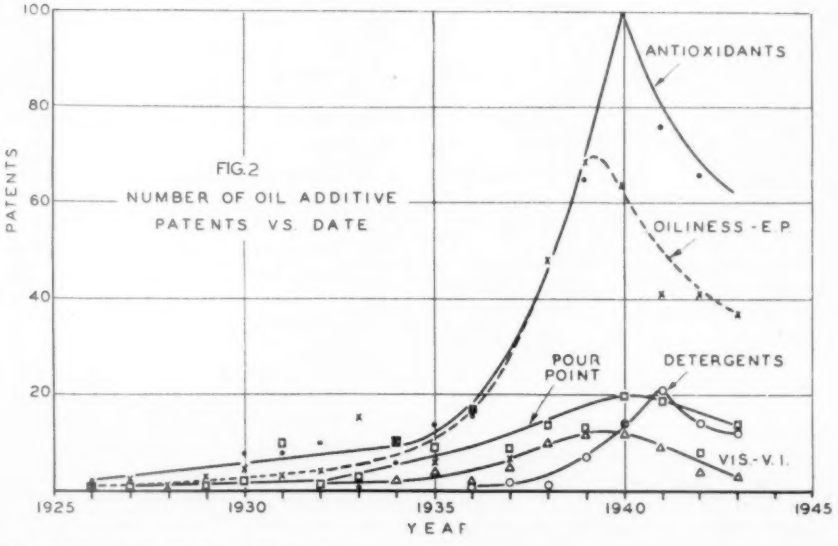

FIG. 2
NUMBER OF OIL ADDITIVE PATENTS VS. DATE

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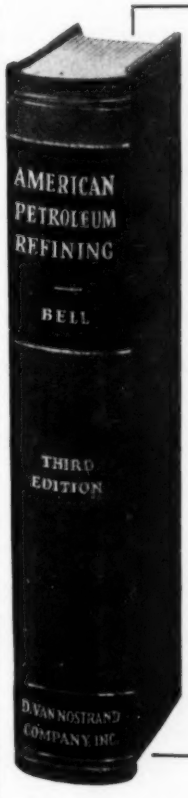

Chapter Headings

General Introductory
Crude Oils and Their Characteristics
Chemical Properties
Physical Properties
Physical and Engineering Data
The Manufacturing Process
The Refinery Side and General Arrangement
Distillation
Heat Transfer
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Shell Stills
Pipe Heaters
Condensers and Heat Exchangers
Distillation Units
Cracking, Theory and Development
Thermal Cracking
Catalytic Cracking
Motor Fuels
Special Processes for Motor-Fuel Blending Agents
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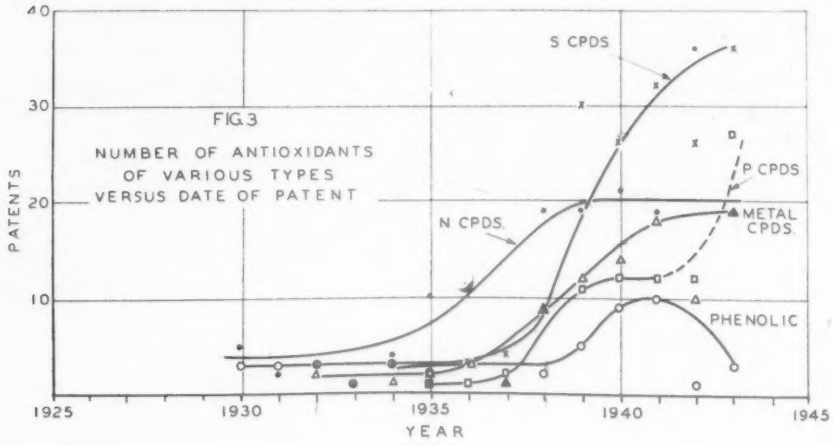

ture comprising over 2000 U. S. patents, and a much smaller technical literature.

Gasoline

An extensive patent and technical literature on stabilization and octane ratings of gasoline exists. The patent literature on gum inhibitors was summarized by J. H. Byers, in 1937[4]. It has not been adequately summarized since then. Most references prior to 1940 are listed in U.O.P. yearly pamphlets "The Cracking Art."[5]

Diesel Fuel

The problem of improving ignition quality of diesel fuels and the patent literature in this field were well summarized by Nygaard, Crandall and Berger[6] in 1941 and in a review article in NATIONAL PETROLEUM NEWS in 1943[7].

Catalyst Deactivators

The basic conception of catalyst deactivators, a discussion of what they are, and how they function, is given in an arcticle by Downing, Clarkson and Pedersen, in 1939[8].

Lubricants

The early patent literature on lubricant additives is summarized by J. H. Byers in a series of articles in NATIONAL PETROLEUM NEWS in 1936 and 1937[9].

Mr. Wright[2] of the Sun Oil Co. listed the patents and summarized the trends in the field of lubricating oil additives in 1944. Fig. 2, 3 and 4 are from his paper, with the original figure numbers, also the data for Table 5 .

Fig. 2 shows number of oil additive patents versus data of patent.

The modern period of activity in this field dates from 1926 and peaks very sharply in 1940. This probably corresponds to a maximum of research activity in 1936-1938. The decline following this period is not because of satisfaction as to the adequacy of present products. It may be to some extent a reflection of war activities but the probability is that we have taken almost every possible compound off the shelf and now have to resort to special syntheses for more compounds to test.

Fig. 3 shows the number of anti-oxidants of various types versus date of patent and Fig. 4 the number of load carrying agents of various types versus date of patent.

Table 5 shows a breakdown of the total number of patents according to probable functional activity and chemical composition. In this table corrosion inhibitors are grouped with anti-oxidants. A more detailed breakdown would show that many compounds, particularly those of sulfur and phosphorus, are polyfunctional and have both anti-oxidant and extreme pressure properties.

Within these patents, we have a number of excellent additives which have proved to be of practical value and have been or are now used commercially. Many more additives have some merit but insufficient for commercial use, while hundreds are useless from a practical viewpoint.

The technical literature on lubricant additives contains a great many papers on the correlation of functional tests, both laboratory bench tests and engine tests, with field service data[13]. Many more papers deal with new functional test methods and with new lubricating oils.

A small number of papers[11, 12], but appearing at more frequent intervals in the last five years, have adopted a more basic approach to the study of the function performed by chemical addition agents. These papers have outlined the factors which control oil oxidation and bearing corrosion and, in some cases, have indicated the probable mechanism whereby additives modify these reactions. A start has also been made on the theory of lubrication in the thin film region and the role additives perform in such lubrication. This more basic approach seems to be the trend much of the new work is following. Of the developments of the last five years one of the most interesting is the elucidation of the mechanism of autoxidation of olefines.

Many theories have been advanced to explain the mechanism of the autoxidation of hydrocarbons but only during the last five years has a theory been advaned which explains the observed facts. Since 1940 studies on the oxidation of pure hydrocarbons by E. H. Farmer[10] and associates of the British Rubber Producers' Research Association and by Larsen[11] and associates of the Shell Oil Co. together with a number of smaller groups[12] have definitely established the mechanism of the low temperature autoxidation of olefines and have indicated the probable mechanism

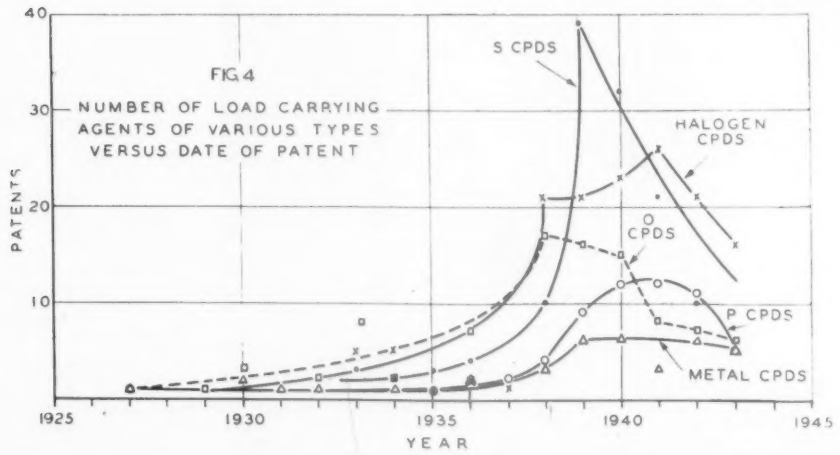

TABLE 5—Number of Patents for Lubricant Additives Issued to 1944

Classified by Probable Function & by Composition

Probable Functions	Total	N°	S°	P°	Halogen	O°	Metals	Hydro-carbon	Misc.
Anti-Oxidants	662	153	195	...	...	48	106	...	64
Oiliness or E.P.	522	...	142	56	146	102	37	...	39
Detergent & Dispersant	95	...	...	...	...	19	65	...	11
Pour Depressants	174	4	...	...	17	66	29	40	18
Viscosity Control	70	...	...	...	...	21	...	19	30
Totals	1523	157	337	152	163	256	237	59	162

° Nitrogen, Sulfur, Phosphorus, Oxygen.

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McKee service is flexible. Our organization is able to handle any phase of your refinery project or to undertake the entire project under a *single contract* within our own organization.

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of the autoxidation of saturated hydrocarbons.

The autoxidation of an olefine does not proceed by adding oxygen across the double bond (Eq. 1) as has been generally postulated in early theories, but rather the oxygen enters at the methylenic carbon atoms in the alpha position to the double bonds and there forms hydroperoxide groups (Eq. 2).

$$-CH=CH- + O_2 \rightarrow -\underset{\displaystyle O}{\underset{|}{CH}}-\underset{\displaystyle O}{\underset{|}{CH}}- \qquad \ldots\ldots(1)$$

$$-CH_2-CH=CH- + O_2 \rightarrow -CH(OOH)-CH=CH- \qquad \ldots\ldots(2)$$

This reaction proceeds by a free radical chain mechanism as illustrated by Eq. 3 and 4.

$$-\overset{\circ}{C}-C=C- + O_2 \rightarrow -\underset{\displaystyle OO^\circ}{\underset{|}{C}}-C=C- \qquad \ldots\ldots(3)$$

$$-\underset{\displaystyle OO^\circ}{\underset{|}{C}}-C=C- + -CH-C=C- \rightarrow -\underset{\displaystyle OOH}{\underset{|}{C}}-C=C- + -\overset{\circ}{C}-C=C- \qquad (4)$$

Alpha methylene hydroperoxides have been experimentally proved to be the primary oxidation products in the oxidation of olefines at temperatures below 100° C. It seems probable, but has not yet been experimentally proved, that saturated hydrocarbons oxidize through a similar mechanism involving displacement of a methylenic hydrogen atom, the enormously higher rates of olefinic autoxidation being due to the enhanced tendency to dissociation of hydrogen promoted by normal electronic displacements in the double bond system.

The general mechanism of autoxidation then would proceed according to Eq. 5 and 6,

$$-\overset{\circ}{C}-C-C- + O_2 \rightarrow -\underset{\displaystyle OO^\circ}{\underset{|}{C}}-C-C- \qquad \ldots\ldots(5)$$

$$-\underset{\displaystyle OO^\circ}{\underset{|}{C}}-C-\underset{\displaystyle H}{\underset{|}{C}}- + -C-C-C- \rightarrow -\underset{\displaystyle OOH}{\underset{|}{C}}-\overset{\circ}{C}-C- + -C-C-C- \qquad \ldots\ldots(6)$$

where the hydrogen removed in forming a free radical is generally that held by the lowest bond strength.

Larsen's data on the oxidation of a variety of pure hydrocarbons at 110° C. appears to fit this picture and anyone familar with the stabilization of gasoline and white oils at 100° C. will have noted their similar behavior. The first step in the autoxidation process therefore attaches oxygen at the methylene group in the form of hydroperoxide groups.

Gasoline and turbine oil inhibitors act by combining with one of the components of the reaction chain and thereby preventing propagation of the reaction chain with accompanying production of hydroperoxide molecules.

In the absence of inhibitors each active center (or free radical), may produce several thousand hydroperoxide groups. It therefore follows that the secondary reaction products normally measured in oxidation studies are the decomposition and oxidation products from these peroxides.

All methylene hydroperoxides decompose spontaneously and by the action of heat. Those from dienes are unstable at room temperature. Those from simple olefines, i.e. cyclohexene, are moderately stable below 40° C. but decompose vigorously if heated to about 120° C., whereas the most stable group, as represented by tertiary butyl hydroperoxide is relatively stable up to 75° C. but decomposes rapidly at 115-130° C.

It appears significant that the upper level of thermal stability of hydroperoxides 115-130° C. corresponds closely with the point of apparent change in the type of oxidation occurring in saturated hydrocarbon systems. The reaction chain pictured above has not been established for reactions above 120° C. and may or may not apply.

This knowledge of the course of autoxidation when further supplemented by studies of the reactions of the hydroperoxides with various hydrocarbons, with and without catalysts, should help greatly in solving the various oxidation problems still facing the industry.

The future for research and progress in the field of chemical additives is extremely promising. The work is veering toward more fundamental investigations of the mechanisms of function. The days of pulling off the shelf or synthesizing at random are over.

The needs are rather clear.

In the field of fuel additives there is an increasing need for combustion assistants for fuel oils. Both cetane number improvers for diesel fuels and improvers for fuels for continuous combustion systems, where the high carbon forming tendencies of the components of relatively low hydrogen-carbon ratio must be overcome, are needed.

In the lubricating oil field there are numerous opportunities for further progress and improvement. The present viscosity index improvers are expensive, and because of their high molecular weight, have the undesirable property of losing their viscosity effect under high rates of shear. The present pour depressants are relatively ineffective in protecting against pour point reversion. All of the so-called detergent type additives for motor oils have to be used in high dosages, and result in the addition of a considerable amount of metal to the oil. This metal concentration must be reduced, particularly if we are to be successful in aircraft engine oil application. The presently known inhibitors for lubricating oils are largely catalyst poisons in the higher temperature range and are only moderately effective.

Our knowledge of the mechanism by which additives function, particularly in the last two classifications, is limited, and is very definitely the restrictive factor. Most good chemists working in this field suspect, and in a few isolated cases they have already proved, that the actual active ingredient of a commercial additive is frequently only a very small portion of the entire additive.

It is estimated that during 1946 between 1- and 200,000,000 pounds of additives will be used in lubricating oil alone at an average value of between 15 and 20 cents per pound. We predict that within three to five years the total value of additives used in lubricants will at least equal, and probably will exceed, $100,000,000 per year.

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PERSONALS

Petroleum Technologists in the Headlines

Adm. de Florez

Rear Admiral Luis de Florez USNR is Deputy Chief of the Office of Research and Inventions of the Navy. The office, it was recently announced, will carry on fundamental research in fuels and lubricants among many branches of science in which the Navy is interested. It is also stated it will finance research projects in college and industrial laboratories in many fields and it is said agreements are being negotiated now with 45 institutions.

Rear Admiral de Florez is well known in the petroleum refining field as a process inventor and design engineer, and has for many years maintained his own engineering company in New York. He graduated from Massachusetts Institute of Technology in 1912 and learned to fly at an early date. In World War I he organized the Division of Aircraft Instruments and Accessories of the Navy.

He was appointed a Lieutenant Commander in the Naval Reserve in 1934 and his activities brought him rapid promotions and he became a Read Admiral in 1940. He was in active service in various theatres of World War II and developed many instruments and safety devices used by flyers. For his services in connection with the anti-submarine warfare in the Atlantic he was awarded the Legion of Merit and for his services as director of the Special Devices Division of the Bureau of Aeronautics of the Navy and as assistant chief of the Office of Research and Inventions he has been awarded the Distinguished Service Medal.

* * *

Com. Marshall J. Waters has returned to the home office of the Shell Oil Co. as engineer in the product application and development department. During the war, Com. Waters served as technical officer and shop superintendent at the Pearl Harbor Navy Yard. Later he acted as petroleum officer with the Seventh Fleet, trouble shooting on petroleum and mechanical problems in all classes of vessels.

* * *

Gerald Forsdick has resumed his position as a safety engineer in the New York office of the Ethyl Corp. following his honorable discharge from the Navy.

* * *

Comdr. Joseph A. Hyland has been appointed chairman of Federal Specifications Committee on Lubricants and Liquid Fuels.

Before donning uniform, Comdr. Hyland was with Gulf Oil Corp. for 11 years, first at Port Arthur, Texas, and later in refining technology at Philadelphia.

* * *

Ralph R. Demsey, a former lieutenant colonel in the Army has recently returned to Standard Oil Co. of New Jersey, where he has been appointed technical assistant in the oil movement and storage department of the Bayway refinery. He succeeds **Wallington J. Ricketts,** who was transferred to the manager's office.

* * *

The Ethyl Corp. welcomes back the following men from the armed services:

Lieut. Com. Robert W. Richardson, USNR, who has been in the Navy since July, 1942, to the Philadelphia division as a field engineer.

Lieut. Stuart Forbes, recently honorably discharged from the Naval Reserve, as field engineer in the New York Division.

Maj. Robert W. Hogan to the Washington office as field engineer.

Lieut. Col. Wayland W. Sweeney, Jr., after four and one-half years service in the Army, as field engineer in the Atlanta division.

Lieut. Marshall D. McDorman, USNR, to the Philadelphia Division as field engineer.

Capt. Redgnald D. Bushell has returned to the New York Division of Ethyl Corporation's Sales Department after more than four and a half years in the Army. Capt. Bushell was an instructor with the Army Air Forces Weather Service on long range forecasting. He spent from March to June, 1944 at California Institute of Technology doing research in this field. In June, 1944, technical consultant team were formulated, and, as a team member, Capt. Bushell traveled throughout southeastern United States and Cuba teaching the latest forecasting techniques. He was later in charge of the training division, AAF Weather Service in Asheville, No. Car.

* * *

Harrison L. Hays, assistant superintendent of the Plains butadiene plant in the natural gasoline and gas department of Phillips Petroleum Co., has been transferred to the main office at Bartlesville.

* * *

W. R. Casserly, recently resigned superintendent of construction and maintenance of Sinclair Refining Co.'s pipeline department, has become assistant to the president and general superintendent of operations of the W. J. Small Co., Inc.

* * *

J. F. M. Taylor, until recently with Shell Oil Co. in New York as vice president of manufacturing, has opened offices as a private consultant at 1155 Lokoya Rd., Napa, Calif.

* * *

Mr. Luster

Mr. Barlow

E. W. Luster was named chief engineer of the Esso Engineering Department, the recent consolidation of the general engineering and process engineering departments of Standard Oil Development Co. The regrouping, said **Dr. N. E. Loomis,** vice president in charge of engineering of Standard Oil Development, is expected to place greater attention on mechanical engineering and engineering research work, improve supervision and increase efficiency.

Under the new setup, **E. H. Barlow,** former chief engineer, becomes consulting engineer of the Development Co. and will handle many of the contacts with company officials on engineering matters. Assistants to Mr. Luster are **P. J. Byrne** of the process engineering department; **C. E. Paules** of the general engineering department and **N. F. Myers,** former associate manager of the process division.

C. T. Harding is named chief process engineer, **C. F. Hesselbach,** chief mechanical engineer, and **A. J. Ely,** chief construction engineer. As part of the reorganization, a group of project engineers

including **G. W. Bauer, E. H. Clendenin, P. J. Harrington, C. A. Hillman, E. H. Kares** and **J. R. Schonberg,** will serve as coordinators on major projects.

° ° °

Charles D. Hawley has been named assistant to the general manager of Ethyl Corp.'s research laboratories at Detroit. **John B. Taylor, Jr.,** will succeed Mr. Hawley as assistant director of engineering research. Mr. Hawley first became associated with Ethyl Corp. in 1927 as an engineer and has had much to do with the establishment of the present laboratories in Detroit as well as the supplementary facilities at San Bernardino, Cal.

Mr. Taylor started with the company in 1930 as a field engineer in the Baltimore Division and in 1934 was transferred to the Technical Service Division. He has worked directly with the engineering research laboratories since 1939.

° ° °

Donald L. Wright, formerly petroleum attache with the U. S. Embassy in London, has rejoined Standard Oil Co. of N. J. in the marketing council division. Mr. Wright participated in operation of the first hydrogenation plant in the U. S. at Jersey's Bayway refinery. In 1943 he was named an industrial-lubricant specialist.

° ° °

R. A. Campbell is now manager of the research and development department of the British American Oil Co., Ltd., Toronto, Ontario, Canada. He was formerly chief chemist of the same department.

° ° °

E. F. Kindsvater has been made manager and **P. M. Arnold** assistant manager of the newly created chemical engineering department of Phillips Petroleum Co. The chemical engineering operations now being carried out by the personnel of the research and development departments will be centralized in this new department.

With the company since 1930, Mr. Kindsvater started in the general engineering department in charge of inspection of materials and equipment for the Phillips Pipe Line Co. In 1931 he started the development of the general engineering department's test division. He served as test engineer until 1940 when he became chief engineer, holding this position until his recent appointment.

Mr. Arnold joined Phillips in 1937, in the research department where he assisted in the direction of engineering and development work. In 1943 he was appointed manager of the process engineering division of the chemical products department.

° ° °

Frederick R. Pratt has been appointed general manager of the Marine Transportation Department of Socony-Vacuum Oil Co., Inc., succeeding **Charles H. Kunze,** who will retire after 41 years with the company.

Mr. Pratt has recently returned to the company after four years service with the Coast Guard. He was discharged with the rank of Lieutenant Commander. After a year and a half of sea duty, Mr. Pratt was on the Army-Navy Petroleum Board in connection with tanker transportation.

° ° °

George V. Carey has been appointed manager of the lubricating oil department of Signal Oil Co., succeeding **J. C. Harding, Jr.,** who has retired.

David E. Day, vice president of Richfield Oil Corp., Los Angeles, was elected a director of the Coordinating Research Council, succeeding Ralph A. Halloran, who recently retired as president of the California Research Corp., research subsidiary of the Standard Oil Co. of California.

Mr. Day

A native of Washington, D. C., he was graduated from the University of Wisconsin in 1918 and after engaging in consulting engineering, joined Richfield Oil Corp. as refinery engineer in 1923. He was made assistant to the vice president in 1936 and became vice president in charge of manufacturing and pipeline transportation in 1945. He served during the war as a member of the Technical Advisory Committee of PIWC.

Major Milton K. McLeod has been appointed to a newly created office of assistant manager of CRC. He was recently released from the Army. He was a research engineer for the Waukesha Motor Co. and was active on various groups of the CRC before he went into the service in 1942, where he was connected with the Air Technical Service Command.

° ° °

Harry Levin of The Texas Co. is chairman of the new standing committee of the API to be known as the Committee on Analytical Research. The committee will continue the type of activity conducted during wartime by the Analytical Subcommittee of the Technical Advisory Committee of Petroleum Industry War Council.

The vice chairman of the new committee is **E. L. Baldeschwieler** of Standard Oil Development Co. **C. E. Headington** of Atlantic Refining is secretary.

° ° °

Paul Saunders has been advanced from refinery foreman of General Petroleum Corp. of Calif. to the position of refinery superintendent. **W. M. Manley** has been promoted to assistant refinery superintendent.

° ° °

M. L. Mayfield has opened offices in Houston, Texas, as consultant on petroleum production, natural gas and gasoline problems. Until recently he has been technical advisor-engineer for the Natural Gas and Natural Gasoline Industry Committee and assistant district director of Natural Gas and Natural Gasoline Division, PAW, District 3.

° ° °

Louis D. Mann has been appointed vice-president and general manager of Cities Service Refining Corp. at Lake

Testimonial Given "Andy" Anderson By His Committee D-2 Friends

A testimonial book from his co-workers on Committee D-2 of ASTM has been presented to **Dr. R. P. "Andy" Anderson,** formerly secretary of Committee D-2 and also secretary of the Division of Refining, American Petroleum Institute, who early in 1945 retired from his various technical duties to live on his farm in Chester county, Pa.

Dr. Anderson

The testimonial is a loose leaf morocco book, 5 x 7 in. The dedication page carries the ASTM seal and states: "This testimonial of our affection and esteem is gratefully presented by your many friends and associates whose names and sentiments are inscribed in the pages which follow." Each leaf carries an original message from one of his friends who contributed to the testimonial fund. There are over 80 cards, the messages on which vary all the way from a signature and statement of good wishes to elaborate displays in the writer's technique, pressed flowers, poems, photographs and advice on how to be successful as a gentleman farmer.

The testimonial book and a check to buy equipment for his farm were presented to Dr. Anderson by T. G. Delbridge, Atlantic Refining Co., vice chairman of Committee D-2, who was chairman of the Anderson Testimonial Committee. Other members of the Testimonial Committee were J. B. Rather, Socony-Vacuum Oil Co., Inc.; A. E. Miller, Sinclair Refining Co., and D. V. Stroop, secretary of the API Refining Division. At the time of his retirement a year ago "Andy" was made an honorary member of Committee D-2.

Charles, La. Mr. Mann started with Cities Service in 1917 as a chemist. Prior to the war, he was assistant general superintendent of all refineries operated by Cities Service Oil Co. and during the war, ran the Maumelle Ordnance Works at Little Rock, Ark. He replaces **William W. Lowe,** who will return to New York to join the staff of Petroleum Advisors, Inc.

G. L. Mateer, former general superintendent at Lake Charles, will also move to New York as technical director of manufacturing operations in the Petroleum Advisors group.

° ° °

Dr. John B. Entrikin has been elected president of the Ark-La-Tex Chemists Club. Dr. Entrikin is head of the chemistry department of Centenary College in Shreveport.

The new vice president will be **Guy Mitchell,** chief chemist for Ozark Chemical Co., and the secretary-treasurer, **D. N. Barrow,** assistant superintendent of the natural gas division of Arkansas Fuel Oil Co.

° ° °

Errol J. Gay has received the highest decoration given civilians by the War Department, the Exceptional Civilian Service Award, for his contribution to the Army Service Forces in "standardizing petroleum products and containers for overseas operations".

Mr. Gay is motor fuel and automotive technician with the Ethyl Corp. and technical consultant to the War Department in this field.

° ° °

E. G. Hammerschmidt, chief chemist of the Texoma Natural Gas Company of Fritch, Texas, succeeds **Emmett B. Reinbold** as chairman of the Panhandle Plains Section of the American Chemical Society.

Mr. Hammerschmidt

Mr. Hammerschmidt was graduated from the University of Iowa with the degree of Chemical Engineer in 1923. He joined the Cities Service Co. and from 1926 until 1931 conducted chemical research in natural gas and gasoline. Since 1931 he has been with the Texoma Co.

Other new Section officers include **Dr. R. G. Atkinson** of the Shamrock Oil & Gas Co., Amarillo, Tex., chairman-elect; and **E. M. Frost, Jr.,** of the U. S. Bureau of Mines, Cryogenic Laboratories, Amarillo, secretary.

° ° °

Charles Wirth, III, formerly Major, Technical Division, Chemical Warfare Service, has rejoined the staff of the Petroleum Chemicals Division of E. I. du Pont de Nemours and Co. after more than three years in the Army. He participated in the development of flamethrowers and also of gas-protective clothing and other equipment.

° ° °

Michael Halpern, vice president of The Texas Co., in charge of the refining department, recently was elected a director of the company.

Mr. Halpern

Mr. Halpern was graduated from New York University with a degree in civil engineering and joined Texaco in 1916 as an assistant civil engineer at the Bayonne plant. In 1930 he became assistant manager of the refining department and director of research. In 1937 he was appointed manager of manufacturing and the following year became general manager. He was elected a vice president in September, 1940.

° ° °

Socony-Vacuum Oil Co. announced the appointment of **Swanton D. Dalton** as chief engineer of the refinery division, manufacturing department, succeeding **George S. Dunham** who will represent midwestern refineries and engineering on the manufacturing committee.

Mr. Dalton started with General Petroleum Corp., a subsidiary of Socony-Vacuum, in March of 1933. In 1938 he became assistant supervisor of General's laboratories and in 1940 was named process engineer of Socony-Vacuum's refinery engineering division. In 1943 he became assistant chief engineer of the refinery engineering division in charge of processing and operating.

A graduate of Stanford U. with a B.S. degree in chemistry, Mr. Dalton later took an M.S. in chemical engineering at M.I.T.

° ° °

Thomas R. Blakeslee, formerly lubricating engineer, Pure Oil Co., Columbus, Ohio, is now sales engineer with the Warren Refining & Chemical Co., Cleveland.

° ° °

W. Hearon Buttrill, formerly of the U. S. Naval Engineering Experiment Station, is now on the staff of the Bureau of Mines Petroleum and Oil Shale Experiment Station at Laramie, Wyo. His present position is assistant chemist.

° ° °

Lt. Col. Warren C. Landis, chief of the Fuels and Lubricants Branch, Maintenance Division, Army Ordnance Department Field Service since March, 1944, is returning to Shell Oil Co., Inc., where he is to be connected with a technical group dealing with the field application of lubricants.

TECHNICAL MEETINGS FOR OIL MEN

MARCH

25-27, Western Petroleum Refiners Association, 34th annual meeting, Blackstone Hotel, Fort Worth, Texas.

29-30, American Gas Association, conference on industrial and commercial gas, Commodore Perry Hotel, Toledo.

APRIL

3-5, Society of Automotive Engineers (Aeronautic) spring meeting Hotel New Yorker, New York.

8-12, American Chemical Society, 109th meeting, Atlantic City.

17-19, Natural Gasoline Association of America, annual meeting, Baker Hotel, Dallas.

18-19, National Petroleum Association, semi-annual meeting, Hotel Cleveland, Cleveland.

22-27, First National Exposition of the Plastics Industry, sponsored by the Society of the Plastics Industry, Grand Central Palace, New York.

28, American Petroleum Institute directors' meeting, Blackstone Hotel, Fort Worth.

29-May 1, Independent Petroleum Association of America, midyear meeting, Houston.

MAY

7-9, National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City.

7-8, Natural Gas Department, American Gas Association, annual spring meeting, Hotel Gibson, Cincinnati.

17-24, International Petroleum Exposition, Tulsa, Okla.

JUNE

2-7, Society of Automotive Engineers, semi-annual meeting, French Lick Hotel, French Lick, Ind.

24-28, American Society for Testing Materials, annual meeting, Statler Hotel, Buffalo, N. Y.

SEPTEMBER

9-13, American Chemical Society, 110th semi-annual meeting, Chicago, Ill.

10-14, Fourth National Chemical Exposition, Coliseum, Chicago.

29-Oct. 2, National Lubricating Grease Institute, 14th annual meeting, Edgewater Beach Hotel, Chicago.

OCTOBER

3-5, Society of Automotive Engineers, Aeronautic Meeting and Aircraft Engineering Display, Biltmore Hotel, Los Angeles.

ADVERTISERS' INDEX

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WIDENING HORIZONS

Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing: Comment from Readers Is Invited

Job of Distributing the German Technical Reports Being Fumbled

Unless the petroleum industry takes the matter entirely into its own hands, it will not possess the valuable data which is available through the reports of the technical missions to Germany. Various governmental bureaus have fumbled the task of digesting and compiling the important information contained in the reports.

The work of securing firsthand from visits to Germany the knowledge of how the Germans were operating their petroleum and synthetic oil plants was done in a most creditable manner through the cooperation of the oil company technologists and the Bureau of Mines staff. Several of the oil companies gave selected technologists leaves of absence to join the government's mission. They collected a great mass of data from their visits to plants and interviews with the German scientists.

Their reports were prepared, sometimes individually and in some cases as teams. Data on the German oil plants were also prepared by technologists from the Army and Navy and other industries. By presidential order these reports were turned over to a specially created Office of Publication Board of the Department of Commerce. A program for publication was announced in which the oil reports, together with those from all other technical missions to Germany, were to be published by the Board and copies made available at small cost.

The letter of this program is being followed. The Board regularly issues a listing of all reports as they are received. The listing tells the form in which they are being published and the price to the public. A statement as of early February tells that the number of reports from the German mission now available has "reached the grand total of 1700."

The total number of reports in itself is staggering. Also their original titles in most cases do not indicate the nature of their contents, or even if it applies to oil plants. In a few cases the editorial staff of NPN's Technical Section secured copies or microfilms of selected reports to expedite passing important data on to refiners. Its experience, however, indicates that very few oil company technical staffs would have the time or patience to go through any great number of the reports in the form in which they are now available. It is to be noted, also, that teams from the technologists who visited Germany are continuing the work started under the Technical Advisory Committee of PIWC of reviewing and abstracting the original German documents sent to this country on microfilm reels. As now set up, however, this part of the work will take a year or more and the reviews when completed will be issued only in microfilm form. This work is being continued under the sponsorship of API and the material is to be distributed by the Bureau of Mines.

While so far only the surface has been scratched in digging out data by subjects, the work has shown that information of considerable importance to refiners in this country is contained in the reports from the German missions. The refining industry should find some means to make the most important of this data easily and quickly available, since the government agencies are not doing it. Some other industries sense the same situation. The Society of Automotive Engineers and the A.I.M.E. arranged sessions for their members where selected reports were presented and discussed.

It is suggested that the Refining Division of the API arrange a session along similar lines for its coming semi-annual meeting. Reviews presented by some of the oil men on the technical missions would at least give a good over-all picture of how the Germans were operating their oil plants. This might lead to another step in making more of the German data available to refiners in this country.

How Many Permanent Buildings For a 5-Year Research Project?

The U. S. Bureau of Mines report on the progress which has been made in its Synthetic Liquid Fuels program (see pg. R-173) raises the question of just how much the Bureau is going to accomplish, in the allotted five years, with the $30,000,000 it has to spend. The liquid fuels project was authorized by Congress nearly two years ago.

If the report can be taken at its face value, very little progress has been made to date in learning how to produce synthetic gasoline and oil from coal and shale. Instead, the Bureau's Office of Synthetic Liquid Fuels has been concerning itself mostly with planning permanent buildings.

At Bruceton, Pa., a completely new research laboratory for hydrogenation and gas synthesis is being erected at a cost (based on contracts already let) of close to $2,000,000, if not more.

At Laramie, Wyo., a completely new research laboratory for oil-shale retorting and refining is being erected at a cost of over $500,000.

At Rifle, Col., a completely new demonstration plant for retorting and refining shale oil is being erected at an unspecified cost. In addition, because of the isolated location of this latter plant, 50 homes to house the personnel are also being built.

It is granted that buildings and similar physical equipment are necessary for any such program as the Bureau has been authorized to undertake. But does the Bureau need all the permanent type buildings for which it is spending millions? For a program authorized to last only five years is it necessary to build brick and steel structures which will stand for the next two or three decades?

Or, looking even further, does the Bureau even have to build right from the ground up the units it requires (as it is doing at Bruceton and Laramie and Rifle)? How about our surplus war plants that now stand idle and empty? Can't more of them be converted and put to constructive use in this program? The existing buildings may not be exactly suited to the Bureau's purposes, or ideally located. But it would seem that there are more that could be incorporated in the program, as was the Missouri Ordnance Works, recently turned over to the Bureau for demonstration purposes. That would leave more of the $30,000,000 of tax payers' money for productive research.

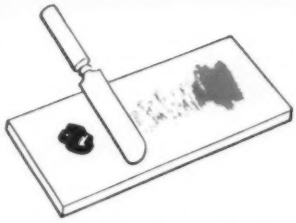
Both the petroleum industry and Congress should follow closely the progress in the Synthetic Liquid Fuels program for the three years remaining, to insure that the work is directed toward developing the type of information that will be of value to the petroleum or other industries that will have to produce synthetic fuels commercially if and when the time comes that substitutes for petroleum are required.

Do Your Operations Require

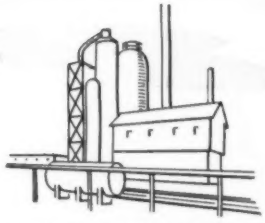
IRON-FREE ALUMINUM SULFATE ?

New Product?

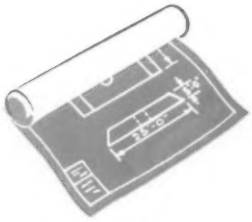
Textile Processing



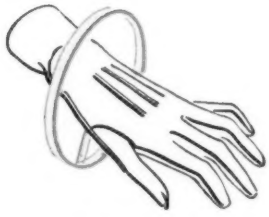
For Color Lakes and Pigments



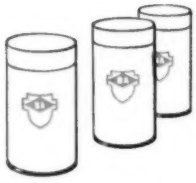
In Catalysts for Oil Refining



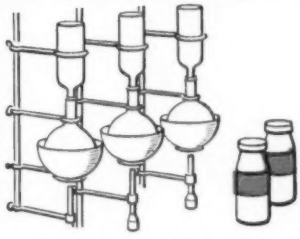
Sizing Special Papers



Leather Tanning



Raw Material for Other Industrial Chemicals



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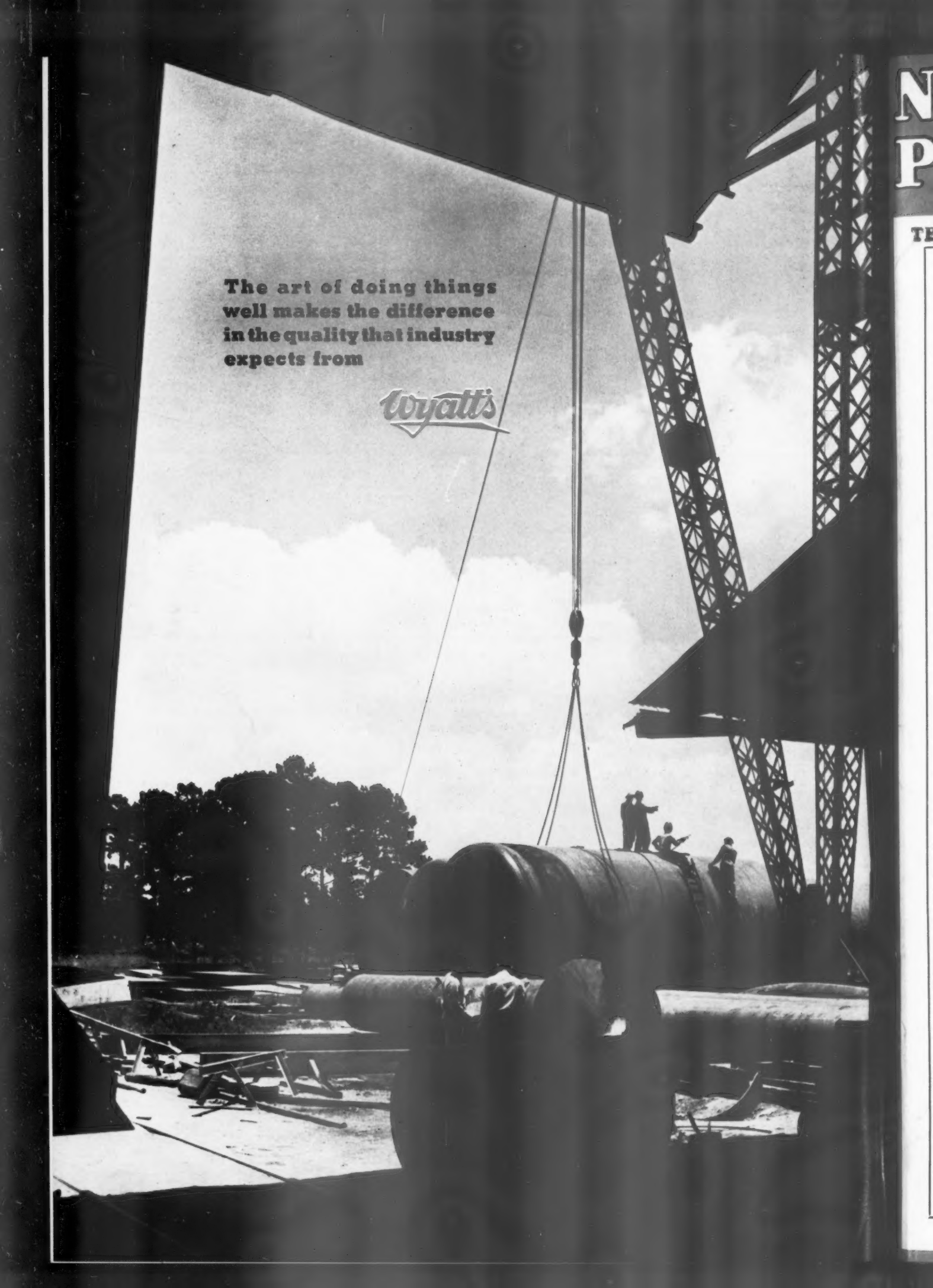
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